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ABSTRACT

This study is designed to provide a better understanding of the Navy's health-care system and the impact of a draft-free system in attracting an adequate number of physicians. The medical scholarship, proposed variable incentive, and present continuation pay scales are evaluated from the standpoint of financial attractiveness to the physician compared to civilian alternatives and the rate of return on the Navy's investment. The conclusion that a new scholarship program and proposed variable incentive pay would attract and retain enough physicians was based on a study of: the present inadequate military compensation, the new scholarship plan enacted in 1972, and the implications of variable incentive pay and bonus. The method of analysis was to compare civilian and military physicians' pay on the national level. Within the economic model of occupational choice, monetary costs and benefits were important factors. The study contains statistical data in tabular form, an explanation of the model, evaluations of alternative and present programs, the utilization of scholarship recipients and civilian physicians, scholarships as profitable investment, and a bibliography. The construction of the analytical model, the comparisons of present proposed military nondisability retirement systems, and the potential use of civilian physicians by the Navy are appended. (Author/JB)

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PROCUREMENT AND RETENTION OF NAVY PHYSICIANS

CENTER FOR NAVAL ANALYSES
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How can the Navy best attain authorized physician staffing levels now that conscription has ended? To answer this question, medical scholarship pay, proposed variable incentive pay, and present continuation pay are evaluated from the standpoint of financial attractiveness to the physician and the rate of return on the Navy's investment. Lifetime earnings under the current and proposed compensation plans are compared with those of civilian physicians. Conclusions are drawn about both the

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20 short and the long range prospects for an adequately staffed all-volunteer Medical Corps.

DEPARTMENT OF THE NAVY
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Encl: (1) Procurement and Retention of Navy Physicians Study Report (CNA/INS #1030 of 9 Nov 1973)

1. The subject study, enclosure (1), examines various incentive programs in respect to their financial attractiveness to physicians and the rate of return on the Navy's investment. It is one of a number of research efforts designed to provide better understanding of the Navy's health care system and the impact of the draft-free environment on factors influencing the system.

2. The study's overall conclusions are that the combination of the new scholarship program and proposed variable incentive pay will enable the Navy to attract and retain enough physicians to maintain a staff at currently authorized levels and to achieve a better distribution of physicians by experience level than is possible under conscription. These two measures, in combination with continued fulfillment of existing Berry Plan commitments, will enable the Navy to successfully make the transition from conscription to an all-volunteer medical corps. These conclusions were based on the following findings:

a. Present military compensation does not provide financial comparability with civilian income and, hence, does not provide a financial incentive for remaining in the service.

b. The new scholarship program will prove financially attractive to prospective physicians under present or proposed military compensation and generally constitutes a good investment for the Navy in comparison with the alternative procurement methods examined.

c. A physician bonus of $15,000 (proposed variable incentive pay) will provide a financial incentive for remaining in the Navy but should not be expected to attract a large number of accessions.

d. Variable incentive pay is a flexible method of adapting to changing market conditions in the all-volunteer environment and, as a personnel management tool, is superior in principle to continuation pay, which it would replace.

3. The following comments should be noted when reviewing the report:

a. Non-pecuniary aspects influencing career decisions have not been included in the economic model of occupational choice, and were not considered when the overall conclusions were drawn. Recent reports, references (a) and (b), address same.

b. Civilian earnings of physicians may be biased downward because available data did not include incorporated physicians, whose reported income is substantially higher than that of self-employed physicians. Data by specialty for incorporated or self-employed physicians was also not available.

c. Based on physician experience, the assumption that a retiring or resigning Navy physician immediately achieves full economic equality with a self-employed civilian contemporary is questionable.

d. Based on a more recent analysis, the assumption that civilian physicians work longer hours, on the average, than Navy physicians may not be valid.

e. The assumption that physicians have historically been the most difficult officer group to retain is not supported by facts.

f. The delayed passage of the proposed variable incentive pay bill may have resulted in an overestimation of the number of projected physicians.

4. Enclosure (1) is forwarded.

T. B. HAYWARD
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Enclosure (1) to CNO ltr Ser 96/827 dated 13 May 1974

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SYNOPSIS

The Department of Defense has devised two economic instruments to replace conscription as a method of obtaining physicians:

1. The medical scholarship program (Public Law 92-426), enacted in September 1972; and

2. The proposed physicians' bonus (variable incentive pay), included as part of the Uniformed Services Special Pay Act of 1973, which has not yet been enacted.

The scholarship program is a means of attracting physicians into the military. The bonus is viewed primarily as a means of retaining physicians, although it will also affect accessions. Because the bonus legislation has not been enacted, we have had to address the question of procurement and retention under alternative assumptions about future compensation of military physicians. The scholarship program will almost certainly be the main source of accessions after the lingering effects of conscription expire, under either the present or proposed system; therefore, it is the focal point of our analysis. We examine both accession and retention from two points of view, that of the physician and that of the Navy. For example, with respect to the scholarship program as a source of accessions, we ask two questions:

1. Will it be financially attractive to the prospective physician compared with his civilian alternatives?

2. Does it constitute a good investment for the Navy compared with alternative methods of procurement?

The method we have chosen to evaluate the attractiveness of military service to the physician is to construct a variation of the economic model of occupational choice. The choices in this case are those of present and prospective physicians between a military and civilian career, and these can be evaluated not only at the outset of a career, but also at any subsequent decision point. The method consists of estimating the present values of the sequence of costs and benefits over time associated with two or more alternatives open to an individual. Standard investment analysis is used to evaluate the Navy's return on investment in the scholarship program.

We considered this to be the best available method of addressing the issue, although it has limitations, as noted below. It has proven useful in predicting the effects of changes in the costs and benefits associated with alternative career choices, and most of the questions we seek to answer are of this nature. It does indicate whether the Navy is able to offer a compensation package to physicians comparable to what they could obtain in the civilian sector. It can be maintained and improved on a continuing basis and

used to anticipate the effects of changes in labor market conditions and to be prepared with an adjustment response.

One major conclusion is that the combination of the scholarship program and variable incentive pay will enable the Navy to attract and retain enough physicians to maintain a staff at or below currently authorized levels. The Navy will also be able to achieve a better distribution of physicians by experience level than is possible under conscription. These two measures, in combination with continued fulfillment of existing Berry Plan commitments, will enable the Navy successfully to make the transition from conscription to an all-volunteer medical corps. It appears highly unlikely that these objectives could be accomplished under present military compensation.

We also concluded that the scholarship program will prove financially attractive to prospective physicians even under current military compensation, and its attractiveness will be enhanced by the proposed compensation. However, present compensation does not enable the Navy to offer the scholarship recipient an attractive financial incentive to remain in the Navy after completion of his obligated service, even if he has eight years of active duty at the time. Nor does it provide a financial incentive for most current Navy physicians to remain. Variable incentive pay will enable the Navy to present a financially attractive career both to future scholarship recipients after completion of obligated service, and to many current Navy physicians who will not remain under current compensation.

Variable incentive pay as a compensation component is superior in principle to continuation pay, which it would replace, apart from permitting an increase in the level of physicians' compensation. It would provide DoD with a flexible compensation device to adapt quickly to changes in market conditions in an all-volunteer environment, and it will greatly facilitate the transition to that environment. In comparison with continuation pay, its advantages are that the amount of compensation may be varied by specialty and compensation is not tied to base pay. Therefore, it will permit a restructuring of the income-experience profile of military physicians so that it more closely resembles that in the civilian sector, with which the military must now compete.

The scholarship program represents a good investment for the Navy compared with attracting fully-trained physicians into uniform, given the compensation levels which would probably be necessary to attract the latter in any appreciable number. It also constitutes a good investment generally compared with using civilian physicians under the method of civilianization we examined, namely, using contract physicians and paying them the median income of self-employed physicians of $44,000 per year. It is clearly a good investment compared with this form of civilianization if the scholarship recipient does not remain for a 20-year career; if he does remain for a career, evaluation of the investment varies depending upon the assumption about amount of compensation necessary to retain him. It does not generally pay the Navy to retain a scholarship

recipient for a 20-year career compared with investing in a succession of scholarship recipients who serve an initial tour only and provide services over the same period.

We also estimated that a minimum of 40 percent of all physician billets could be civilianized while retaining a sufficient number of military physicians for those purposes commonly thought to require them, such as quick response to contingencies and the provision of support in combat areas. Whether it pays to civilianize all these billets is another question, and we have shown that under one method of civilianization it generally does not. We did not analyze the relative costs of civilianization under present Civil Service pay scales and policies because of doubts about the Navy's ability to obtain enough civilians under this system. We also did not analyze civilianization under a revised compensation system for federal civilian physicians, although in retrospect it is clear that such a system may provide a cost-effective means of civilianizing and should be analyzed.

Finally, we analyzed the proposed military nondisability retirement system in comparison with the present system (all else equal). The effect on accessions will be negligible. With respect to the avowed purpose of the new system, viz., to induce critical professionals to remain for a 30-year career, it is clear that the effect will be the opposite, unless countermeasures are undertaken such as the physicians' bonus. There will be a greater incentive to remain for 30 years given that an individual remains for 20 years, but the proposed system increases the incentive to leave at mid-career rather than remain for 20 years.

Limitations

1. The model employed cannot take into account the nonmonetary factors which are important in career choice. Whether a given compensation package is "competitive" in the sense of enabling the Navy to attract and retain enough physicians can only be determined when that package is actually offered. Nevertheless, it appears to be the best available method of anticipating response to compensation.

2. Our results are potentially sensitive to the assumptions we have had to employ and to weaknesses in available data. These are too numerous to recite here, and are detailed in an appendix. However, a major limitation is in the data used to represent the alternative civilian earnings available to physicians. We used the median earnings of all self-employed physicians by years of experience. In our judgment, these were the best available. However, we would have preferred to examine the earnings-experience profiles by major specialties and for incorporated as well as self-employed physicians. The lack of data on earnings of incorporated physicians biases our civilian earnings estimates downwards, although there are other factors which create a bias in the opposite direction.

3. Time did not permit us to analyze all the relevant alternatives. For example, it appears that the alternative of civilianization under a revised system of compensation for federal civilian physicians deserves analysis.

4. We did not address a radical restructuring of the compensation system for military physicians, such as abolition of the grade structure and substitution of an entirely new compensation system, even though this may be the most efficient system. Instead we confined our analysis to the present compensation system and changes currently being proposed by the Department of Defense.

Recommendations

1. We recommend strong support of variable incentive pay, both as a means of raising the level of compensation of military physicians and as a superior compensation tool to continuation pay, which it would replace. This is important both for successful transition to an all-volunteer medical corps and for maintaining that corps after the transition.

2. We recommend that an analysis of civilianization under a revised system of compensation for federal civilian physicians be undertaken. Such a system would more closely resemble that proposed by the Job Evaluation and Pay Review Task Force than the present Civil Service system. However, such a system should provide for flexibility in compensation according to both medical specialty and geographical area.

3. Career retention goals should be carefully formulated in view of our finding that it does not generally pay to retain a military physician until retirement because of the heavy retirement costs.

PROCUREMENT AND RETENTION OF NAVY PHYSICIANS

I. INTRODUCTION AND MAJOR CONCLUSIONS

A. Introduction

The purpose of this paper is to ascertain whether and how best the Navy can obtain physicians now that conscription has ended. Procurement of physicians is considered a major subject for concern in the establishment of an all-volunteer armed force. This concern arises for two reasons. First, physicians have the highest civilian earnings opportunities of any occupational group in the Navy. Largely because of this, they have historically been the most difficult officer group to retain after completion of obligated service. Second, the military has not had to compete economically for physicians in over 30 years. Procurement has been almost entirely through conscription and conscription-related sources, such as the Berry Plan. This makes it difficult to determine in advance the compensation necessary to attract physicians voluntarily.

The Department of Defense has devised two economic instruments to replace conscription as a method of obtaining physicians:

1. The Medical scholarship program; and
2. The proposed physicians' bonus (variable incentive pay).

The medical scholarship program was enacted in September 1972 (Public Law 92-426); it provides scholarships for medical students in return for a subsequent military service obligation. Under the bonus proposal, the military would be able to pay physicians a bonus of up to $15,000 per year, in addition to other pay and allowances. It was first submitted to Congress in 1972, and again in 1973 (as part of the Uniformed Services Special Pay Act of 1973), but it has not yet been enacted. The scholarship program is viewed primarily as a means of attracting physicians into the military and the bonus as a device for retaining them, although it will also affect accessions.

The bonus legislation is by no means assured of passage, and we have had to address the questions of procurement and retention under alternative assumptions about future compensation of military physicians. Whatever future compensation may be, the scholarship program will almost certainly be the major source of accessions after the lingering effects of conscription expire during the next few years; therefore, it is the focal point of our analysis. We examine both procurement and retention from two points of view, that of the physician and that of the Navy. For example, with respect to the scholarship program as a source of accessions, we ask two questions:

(1) Will it be financially attractive to the prospective physician compared with his civilian alternatives?

(2) Does it constitute a good investment for the Navy compared with alternative methods of procurement?

Obviously, these considerations work in opposite directions, and we seek to identify programs which are mutually beneficial, that is, which are financially attractive to both the physician and the Navy. The alternative procurement methods compared with the scholarship program were: (1) attracting fully-trained physicians as Navy officers; and (2) using fully-trained civilian contract physicians to the extent that the military mission permits.[1]

B. Assumptions and Limitations

In the course of our study it was necessary to make numerous choices about the data and assumptions to be used, and many of the conclusions are potentially sensitive to the choices made. Therefore, our method, data and assumptions have been presented in great detail in appendix A so that others may replicate our results, substitute other assumptions, use better data as it becomes available, or analyze different career patterns than those in this report. However, before summarizing our conclusions it would be useful to indicate the major assumptions and limitations which may affect them. These assumptions and limitations are:

1. Any changes in the incomes of civilian and military physicians over time will be the same in absolute terms.

2. In all military income streams in which the bonus is a component, the physician views it as to be received with certainty, although the Secretary of Defense may terminate it at any time.

3. Navy interns and residents perform services equal in value to their compensation during these postgraduate training years.

4. The physician who leaves the Navy at any point in his career can immediately obtain the same income as his counterpart with the same experience.

5. No adjustment has been made for the fact that the civilian physician works longer hours on the average than the Navy physician.

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[1] In appendix C we estimated that a minimum of 40 percent of Navy physician billets could be filled with civilians consistent with the military mission. In the text we analyze whether it would pay to do so if these physicians were to be paid the median income prevailing in the civilian sector. This method of civilianization was chosen for the comparison because it is doubtful that a sufficient number could be attracted under the present Civil Service system.

6. We did not include any estimates of earnings from part-time work in the civilian sector ("moonlighting") while on active duty in the income streams of Navy physicians.

7. The data used to estimate the alternative earnings available in the civilian sector were median incomes of self-employed physicians by years of practice for all specialties combined.

We consider this last limitation, which was imposed by data availability, to be a major one. Median incomes in the civilian sector are known to vary substantially by specialty. Therefore, our conclusions are most applicable for specialties in which the median income approximates the median for all physicians. For specialties with incomes substantially higher or lower than this, our conclusions may be either reinforced or reversed.

C. Summary of Major Conclusions

We conclude that the combination of the scholarship program and variable incentive pay will enable the Navy to attract and retain enough physicians to maintain a staff at or below currently authorized levels. They will also enable the Navy to achieve a better distribution of physicians by experience level than is possible under conscription. These two measures, in combination with continued fulfillment of existing Berry Plan commitments, will enable the Navy to successfully make the transition from conscription to an all-volunteer medical corps. It appears highly unlikely that these objectives could be accomplished under current military compensation. The scholarship program generally constitutes a good investment for the Navy in comparison with the alternative procurement methods we examined. Variable incentive pay is a flexible method of adapting to changing market conditions in an all-volunteer environment. Apart from increasing the level of military physicians' compensation, as a personnel management tool it is superior in principle to continuation pay, which it would replace.

Our detailed conclusions are presented in sections IV and V; our major conclusions are summarized below.

Present Military Compensation

(1) The scholarship program should prove sufficiently attractive to fill the currently authorized number of scholarships, given sufficient time to disseminate information.

(2) The military service obligation currently prescribed by the Secretary of Defense for scholarship recipients should not be changed at this time.

(3) Virtually no fully-trained physicians will be voluntarily attracted into the Navy.

(4) Present military compensation will not enable the Navy to provide the scholarship recipient with a financially attractive incentive to remain beyond his obligated service, even when he has completed eight years of active duty at the time. The same

conclusion applies to current Navy physicians with eight (or more) years of active duty, and a Navy career is even less attractive to those with fewer years of service.

(5) It will be difficult to achieve the transition to the all-volunteer force under present compensation, and maintaining authorized staffing levels will probably be difficult even in the long run.

Variable Incentive Pay

(6) The financial attractiveness of the scholarship program will be increased.

(7) Some fully-trained physicians could be attracted, but this would probably require maximum use of the bonus authority. We would not expect a large number of accessions from this source.

(8) The Navy would be able to offer a financial incentive for the scholarship recipient to remain in the Navy after completion of his obligated service. Variable incentive pay would also enable the Navy to achieve a rapid increase in retention rates of current physicians.

(9) The Navy should be able to achieve both authorized staffing levels and reasonable goals with respect to the distribution of physicians by experience levels.

(10) The transition to an all-volunteer force would be greatly facilitated.

(11) Variable incentive pay would replace continuation pay; apart from its effect on the level of military compensation, it is superior in principle as a compensation component. It would enable a restructuring of the income-experience profile so that it more closely resembles that in the civilian sector, with which the military must now compete.

The Scholarship Program as An Investment

(12) The scholarship program is generally a good investment for the Navy compared with using civilian contract physicians at the median income prevailing in the civilian sector.

(13) The scholarship program represents a good investment compared with attracting fully-trained physicians into the Navy, given the compensation levels which would probably be necessary to attract the latter in any appreciable number.

(14) It does not generally pay the Navy to retain a scholarship recipient for a 20-year career compared with investing in a succession of scholarship recipients who serve only the initial obligation. This should be weighed in the formulation of career retention goals.

Proposed Nondisability Retirement System

(15) The proposed military nondisability retirement system in comparison with the present system (all else equal), will have a negligible effect on attraction into the

scholarship program, decrease retention at the mid-career point, and increase retention at the 20-year point, for those who enter after it becomes effective.

(16) For physicians already in the Navy, the incentive to remain at the mid-career point will be diminished, but to a lesser extent than for those who enter afterwards, and the incentive to remain at the 20-year point will be unaffected.

Civilianization

(17) At least 40 percent of all physician billets could be civilianized while retaining a sufficient number of military physicians for those purposes commonly thought to require them, such as quick response to contingencies and the provision of support in combat areas. This percentage would vary from zero to 100 percent, depending upon the specialty.

(18) Whether these billets should be civilianized depends upon the relative costs of staffing them with military and civilian physicians. (a) Conclusion (12) states that it would be generally better to procure military physicians through the scholarship program than to use civilian contractors at the median income prevailing in the civilian sector. (b) Procurement under present Civil Service pay scales and policies would probably be less expensive, but was not analyzed because it is doubtful that a sufficient quantity and quality could be obtained. (c) A revised method of compensating federal civilian physicians may enable the Navy to attract enough well-qualified civilian physicians. This possibility should be analyzed, but time did not permit us to do so.

II. METHOD OF INVESTIGATION

The method we have chosen to evaluate the attractiveness of military service to the physician is to construct a model which is basically the standard economic model of occupational choice. In our study the choices examined are not primarily among different occupations, but rather the choices of present or prospective physicians between a military and civilian medical career. However, the DoD scholarship program, by lowering the cost of a medical education, may well induce some individuals to choose a medical career who would not otherwise have done so. We chose this approach rather than attempting to estimate "elasticities of supply" because it was our judgment that we would not be able to obtain reasonable elasticity estimates.[2]

The economic model of occupational choice consists of an estimation of the sequence of costs and benefits over time associated with two or more alternatives open to the individual. It is based on the premise that these monetary costs and benefits are important factors affecting that choice, not that they are the only factors. This model has been found particularly useful for predicting the effects of changes in the costs and benefits associated with one alternative relative to another, and most of the questions we seek to answer are of this nature. The model may be used to analyze choices not only at the outset of a career, but also at any subsequent decision point, such as the end of obligated service or the completion of 20 years of active duty.

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[2] The term "elasticity of supply" means the change in one variable, such as the number of physicians willing to serve in the military, associated with a small change in another variable, such as military compensation. This is elasticity with respect to compensation. It seems clear that a small increase in the incomes of military relative to civilian physicians would attract few volunteers, and the approach is not well suited for evaluating the response to large changes such as the proposed physician bonus. Other elasticities to be estimated would be with respect to the reduction in the cost of medical education under the scholarship program, and with respect to the length of obligated service the program entails.

Sloan has presented evidence that medical education costs have a substantial impact on occupational choice. This is encouraging for the prospects of success of the DoD scholarship program. However, it is inconclusive because we cannot estimate the effect of a simultaneous reduction in these costs and acceptance of a substantial military service obligation. (Frank A. Sloan, "Economic Models of Physician Supply," unpublished Ph. D. dissertation, Harvard University, 1968 and "The Demand for Higher Education: The Case of Medical School Applicants," The Journal of Human Resources, Vol. VI, No. 4, Fall 1971, pp. 466-489.)

One limitation of the model is that it cannot evaluate the nonmonetary factors involved in the choice between a military and civilian career. A compendium of studies prepared in 1969 identified a number of nonmonetary factors which adversely affect the retention of military physicians, such as frequent moves, undesirable geographical locations, and unrewarding professional assignments.[3] It is widely believed that nonmonetary factors will, on balance, work against the military.

What this model can show is whether the Navy can provide the physician with an income which is comparable to what he could obtain in the civilian sector. We do not use the word "competitive" because of our inability to assess the nonpecuniary factors. Conclusive evidence about whether a given compensation package is "competitive" awaits the acid test of the market. That is, does the package, when actually offered, attract and retain an adequate number of physicians or not? If the compensation is inadequate, shortages will develop; if overly generous, there will be an excess of qualified applicants. The latter may be taken as prima facie evidence that a program is more costly than necessary; that is, that a restructuring could be devised to achieve the same results at lower cost.

As we have said, recruiting and retention experience will provide the acid test, and the Navy could simply wait for shortages or queues to develop and then adjust to them, but we do not believe that this is an efficient method. We believe we have a tool which will enable us to assess, a priori, the impact of future developments so that we can be prepared to cope with them before or at the very onset of the manifestation of shortages and queues. It should prove less costly to anticipate changes and be prepared with an adjustment response, rather than to wait for them to materialize and then attempt to identify the appropriate adjustment in a "brushfire drill."

It is proposed that the model be maintained on a continuing basis. As data are generated by experience, or better estimates of some of the compensation components become available, or new proposals arise, the model can readily be modified and the financial consequences of the changes for both the physicians and the Navy can be traced out. We can consider the likely effects of change in variables such as military pay, civilian physicians' incomes, or the financial assistance available to civilian medical students.

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[3] LTC Gilbert L. Jacox, MSC, U.S.A., "A Compendium of Studies on Career Retention: Factors Relating to Early Resignation or Retirement of Physicians in the Military Medical Service," Prepared for the Deputy Assistant Secretary of Defense (Health and Medical), July 17, 1969.

III. SUMMARY DESCRIPTION OF THE MODEL

A. Choice of Static or Growth Version

After deciding upon the use of the economic model of occupational choice, we still had to make numerous decisions about how to apply the approach. Three types of problems arise:

(1) the problem of which alternative civilian income streams to compare with the Navy streams;

(2) the problem of estimating the components of any given pair of alternative income streams; and

(3) the question of whether to use current experience-income relationships (cross-sectional data) for the income streams or whether to project growth rates in these streams.

The first two problems are discussed in detail in Appendix A; discussion of the third is appropriate at this point.

The medical student or physician has two basic choices in projecting the costs and earnings associated with any set of alternatives: he can either assume that the current relationships between two income streams will remain the same, or he can project some rate of real growth (i.e., growth in terms of dollars of constant purchasing power) in these streams. If he projects growth, he may project the same rate in each stream or he may project a higher rate for one than the other. There appears to be no way for the investigator to establish, a priori, which of these approaches would serve better in explaining career choice.

The use of current age-income relationships does not imply that one literally expects no changes to occur in the values of the streams, but rather that his best guess about the future is that the relationship between the streams will remain the same.[4] It may (and has) been argued that this expectation is certain to prove wrong, but the question then arises as to what growth projections to use. Will civilian physicians' incomes increase at a greater, lesser, or the same rate as military physicians' incomes? What will be

[4] To say that "the relationship will remain the same" in this context means that it will remain the same in absolute rather than percentage terms, that is, a dollar increase in a future year in one of the streams will be matched by a dollar increase in the other in that year. Application of an equal percentage increase to the two streams will change the present values of these streams, and, more importantly, the difference between the present values.

the rate of inflation? The results can be quite sensitive to these assumptions. There are numerous other difficulties involved in compounding over long periods of time and in projecting other components of compensation and taxation. We have little confidence in our ability to project these variables and even less in our ability to guess what projections the average medical student or physician may make. In addition, growth projection renders the computations more complex; income variables must be inflated first, the federal tax rates applied next, and the after-tax incomes then deflated. There was not time to employ both approaches, and in our judgment it did not appear worthwhile to use a growth model.

However, one serious difficulty arises when the cross-sectional version of the model is applied to a comparison of military and civilian careers. This is because of the military retirement system.[5] During the active duty years, our assumption that absolute increases in incomes would be the same for both military and civilian physicians allowed us to ignore increases in the general level of military base pay. However, unless we make the assumption that there will be literally no change in the two streams over a period of more than 20 years, which we are unwilling to do, the military physician's final base pay will be higher than it is for an officer with the same rank and length of service today. Therefore, his pension will be higher. We have assumed that upon retirement he pursues a second career and is able to obtain the same income as his all-civilian counterpart with the same experience. This means that during the post-retirement years the former military physician's income will necessarily increase differentially relative to the civilian's. To take account of this differential increase, we have adjusted the pension upward.[6] We are primarily concerned with the differences in present values between two alternatives, and for this purpose the cross-sectional approach seems appropriate, except for the military retirement component in which adjustment was necessary in order to obtain a better estimate of these differences.

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[5] We are indebted to our consultant, Professor Harry Gilman of the University of Rochester, and to Capt. Lawrence Kolbe, USAF, of the Medical Personnel Volunteer Task, for calling this point to our attention.

[6] We assumed a real growth rate (i.e., constant dollars) in base pay of 2 percent per year. Today an 0-6 retiring with 24 years of service has a final base pay of $22,824 and a pension of $11,412; if he entered today and retired in 24 years as an 0-6, his final base pay would be $36,750 and his pension $18,355 under our compounding assumption. Therefore, in the income profile of a scholarship recipient entering today, the upward adjustment in the pension is about $7000 per year.

B. Construction of the Model

The way in which the model has been constructed can best be explained by illustrating it for one of the career patterns examined. For this purpose, we shall show how we constructed the lifetime earnings and present values for an individual who accepts the DoD scholarship from the beginning of medical school. We have assumed that this individual is 22 years of age at the time he enters medical school, that he undertakes a one-year service internship and a three-year service residency, serves 20 years on active duty and retires from the Navy at age 46, then pursues a civilian career until age 65, at which time he fully retires.

Table 1 shows the components of compensation which enter into his lifetime income stream. Some of these elements (such as continuation pay and the bonus) are mutually exclusive; we have estimated the income streams under the alternate assumptions of present and proposed military compensation. The table summarizes a matrix in which the rows contain the various components of compensation and the columns show the years in which various amounts are to be received. Year 1 is the first year of medical school.

In table 1 we first list the several components of taxable income which may be received at various stages throughout the individual's lifetime. The first such item is base pay. During the first four years this consists of the stipend of $400 per month for 10-1/2 months and the pay and allowances of an 0-1 for 1-1/2 months of each year. In year 5, upon graduation, he enters active duty as an 0-3 with 4 years of service for pay purposes, and he retires at the end of year 24 as an 0-6 with over 22 years of service for pay purposes. Entry grade, promotion and credit for pay purposes are as specified in DoD Directive 1320.7.

The next item is special pay, which is entered either at the current rates or at the rates set forth in the "Uniformed Services Special Pay Act of 1973" sponsored by DoD. In either case, the man first receives special pay in year 6, after completion of the internship, and it continues throughout his active duty career.

The next two items are continuation pay and the bonus. If the new legislation is enacted, continuation pay will be eliminated. We have assumed 4 years of post-graduate training in military facilities, and these years are not creditable in satisfying the active duty obligation incurred by accepting the scholarship. Therefore, obligated service is not completed until after year 12, eight of which have been on active duty. Neither continuation pay nor the bonus would be paid until obligated service has been completed. Under the present pay system, we assume that continuation pay will be received during all years beyond the initial obligation (years 13-24) at the rates specified in DoD Directive 1340.8. DoD has considerable flexibility with respect to the bonus, which may be paid in any amount ranging from zero to $15,000 per year in any or all years beyond obligated service. In

our calculations, we have used two alternative assumptions about the bonus: (1) that the maximum of $15,000 is received during all years of unobligated service (years 13-24); and (2) that a bonus of $10,000 is received during these years.

TABLE 1

CONSTRUCTION OF THE MODEL: DOD SCHOLARSHIP RECIPIENTS

Elements of taxable income	Year
Base pay	1-24
Special pay - current or proposed	6-24
Continuation pay - current or proposed (zero)	13-24
Bonus, $10,000 or $15,000	13-24
Retirement pay - current or proposed	25-
Post-retirement career	25-43
Keogh Plan contribution (subtract)	25-43
Keogh Plan benefits	44-
Step 1 - Add these items to get adjusted gross income	All years
Step 2 - Deduct Federal Income Tax and Social Security Taxes to get income after taxes	All years
Step 3 - Add BAQ, BAS, and Social Security benefits to get net cash pay	1-24, 1-24, 44-
Step 4 - Add value of medical care, disability insurance, commissary privileges to get net total income	9- , 5-24, 5-24
Step 5 - Adjust for survival probabilities	14-85
Step 6 - Discount at 0, 5, 6, 7, and 10 percent to get present values	All years

Under this profile, retirement pay will commence 25 years in the future, after a 20-year active duty career, and continue until the man's death. Again, we are confronted with two possible alternatives, namely, the current (non-disability) military retirement system or the new system proposed by DoD.[7] In the calculations presented here, we have assumed the present retirement system throughout. In Appendix B, we compare the present and proposed retirement systems in order to ascertain the effects of the proposed system on procurement and retention.[8]

The next element of compensation consists of the earnings of the retired Navy physician while pursuing a second career during the years 25 through 43 (ages 46-65). We have assumed that during these years he receives the median income of a self-employed civilian physician with the same training and length of experience. We also assume that during these years he sets aside an additional $2500 toward complete retirement under the "Keogh Plan," as do most of his civilian counterparts. This amount is subtracted from his income because it is "tax-sheltered," i.e., it is exempt from federal income tax during these years. We assume that the return on investment of these annual contributions is 6 percent per year, and estimate the accumulated fund he will have upon retirement at age 65 (year 44). We then assume that he purchases an annuity at this age which continues for the rest of his life. This annuity will be subject to full income taxation during the years in which it is received.

These compensation elements are added during the years in which they are received to get "adjusted gross income," or the income subject to federal taxation. The applicable federal income and social security taxes are then estimated and deducted from adjusted gross income. We were unable to estimate state income taxes. To this after-tax income, we add nontaxable cash income, namely, the basic allowances for quarters and subsistence during the active duty years and the social security benefits during the years of full retirement, in order to get net cash income.[9] We then add conservative estimates of the monetary value of three principal nonmonetary elements of compensation to get total net income.

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[7] "The Proposed New Military Nondisability Retirement System," Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs), 1973.

[8] In an earlier version of this study, we used the present retirement system in some calculations and the proposed system in others. This proved to be somewhat confusing to the audience. ("Procurement of Military Physicians After the End of Conscription," A Briefing Presented to Representatives of BuMed, OASD(H&E), OP-96, and BuPers by E. J. Devine on 27 April 1973.)

[9] The use of after-tax incomes automatically values tax free cash elements correctly; it is not necessary to estimate the taxable equivalent of these items under this procedure.

The net incomes at each age were then weighted by the related survival probabilities, using data furnished by the Defense Department's Actuarial Consultant.[10] The final step was to discount these weighted, after-tax, lifetime income streams to estimate present values. The evaluation of future income (the rate at which it is discounted) will vary among individuals, and no single rate can be regarded as "the" correct one. Therefore, we have used a range of discount rates which we considered reasonable in order to indicate the sensitivity of the present value calculations to the rate.[11]

The same method was used for estimating the present values of other career patterns, although the components of the cost and benefit stream vary with the alternative being examined. For example, we compared acceptance of a DoD scholarship with the alternative of an all-civilian career. Some of the different items entering the latter stream include payments for tuition and fees during the medical school years, entered as negative amounts, partially offset by certain widely available loans and grants during these years, and loan repayments in subsequent years, again entered as negative amounts.

When we examine the alternatives from the Navy's point of view, there are likewise differences in the items entering the cost and benefit streams. For example, second-career income does not enter at all, and taxes are not deducted from salaries because it is the gross salary which constitutes the Navy's outlay.

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[10] In table 1, no termination year is shown for "open-ended" benefits, such as retirement pay; in our calculations we weighted retirement pay by the survival probabilities beginning at age 36 through age 107.

[11] In considering the discount rates employed, the reader should bear two factors in mind. First, because our income streams are in constant dollars, the rates are net of uncertainty with respect to the future course of the price level. Second, they are net of uncertainty with respect to receiving these sums except for the probability of death, for which an adjustment has been made. That is, there is no uncertainty about such matters, as, say, whether the man will in fact be promoted more or less rapidly than indicated in the profile.

IV. EVALUATION OF ALTERNATIVES FROM THE PHYSICIAN'S VIEWPOINT

We shall now analyze three principal sets of choices to be made by medical students or physicians:

1. The medical student's choice between accepting or declining a DoD scholarship.

2. The scholarship recipient's choice of remaining in the Navy or leaving upon completion of obligated service.

3. The fully-trained physician's choice between a military or civilian career.

For each set of choices, at least four different income patterns have been examined. Three of these income patterns represent different assumptions about the future compensation of military physicians. Each is compared against a civilian alternative.

Our procedure is first to present and discuss graphs of some of the income streams associated with each choice set. This will enable the reader to readily observe the differences among the streams at various points in time. We then present and discuss tables showing the present values of the streams. The numerical estimates of the components used in constructing the income streams are presented in tables A-12, A-13, and A-14 of Appendix A. The after-tax lifetime income streams associated with the 16 career patterns analyzed are shown in table A-15.

A. Attraction Into the Scholarship Program

We shall first consider the medical student's choice between financing his own medical education and pursuing a civilian career, or accepting a DoD scholarship for four years and pursuing a 20-year Navy career. The first four lifetime income streams to be considered are:

1. Paying his own way through medical school, with the assistance of certain loans and grants widely available to civilian medical students, and pursuing an all-civilian career.

The next three income streams all involve accepting a 4-year DoD scholarship and a 20-year active duty career, with the present retirement system in effect. They differ with respect to the assumptions made about military physicians' compensation.

2. The present military compensation system is assumed; physicians receive special pay and continuation pay under present schedules.

3. The bonus legislation is passed; the new special pay schedule is in effect, and DoD decides to pay the physician a bonus of $10,000 per year for all unobligated years (i.e., years 13-24).

4. Same as number 3, but the bonus is $15,000 for all unobligated years.

Figure 1 shows a graph of the first three of these income streams over a 50-year period. The incomes graphed are net of taxes, but have not been adjusted for probable mortality. We shall next discuss the major differences among these streams and the fluctuations over time.

First 4 years: The civilian income is well below the two Navy income patterns, which are identical during these years. In fact, the civilian income is negative because the medical student bears his own expenses, which are only partially offset by loans and grants.

Second 4 years: Civilian income is well below either Navy income stream during the internship and residency years. Income is higher under the new pay legislation in years 7 and 8 because of higher special pay.

Years 9-12: During these years, the Navy physician is performing his obligated service, and income under either Navy pay system is well below the civilian sector because no continuation pay or bonus is paid during these years.

Years 13-24: These are the unobligated years of active duty. At the end of year 12, the scholarship recipient has 8 years of active duty and at the end of year 24 he has 20 years. Under the present compensation system, Navy income is well below civilian income during most of these years, but gradually approaches the civilian level in the last year of active duty. Under the $10,000 bonus, Navy income is below the civilian level during years 13-20, but almost equals it during the last 4 years of active duty. Income under the present pay system is only slightly lower than with the $10,000 bonus in the final year of active duty because continuation pay at this point has increased to $7600 per year. Had we graphed the $15,000 bonus, Navy income would match and even slightly exceed the civilian stream during all the unobligated years.

Years 25-43: During these years both Navy patterns are identical and well above the civilian level. We have assumed that the retired Navy physician is able to obtain the same income as his civilian counterpart during his second career, and he received his Navy retirement pay in addition. These years account for a major part of the payoff for a physician choosing a Navy career; the other part occurs during the medical school and postgraduate years.

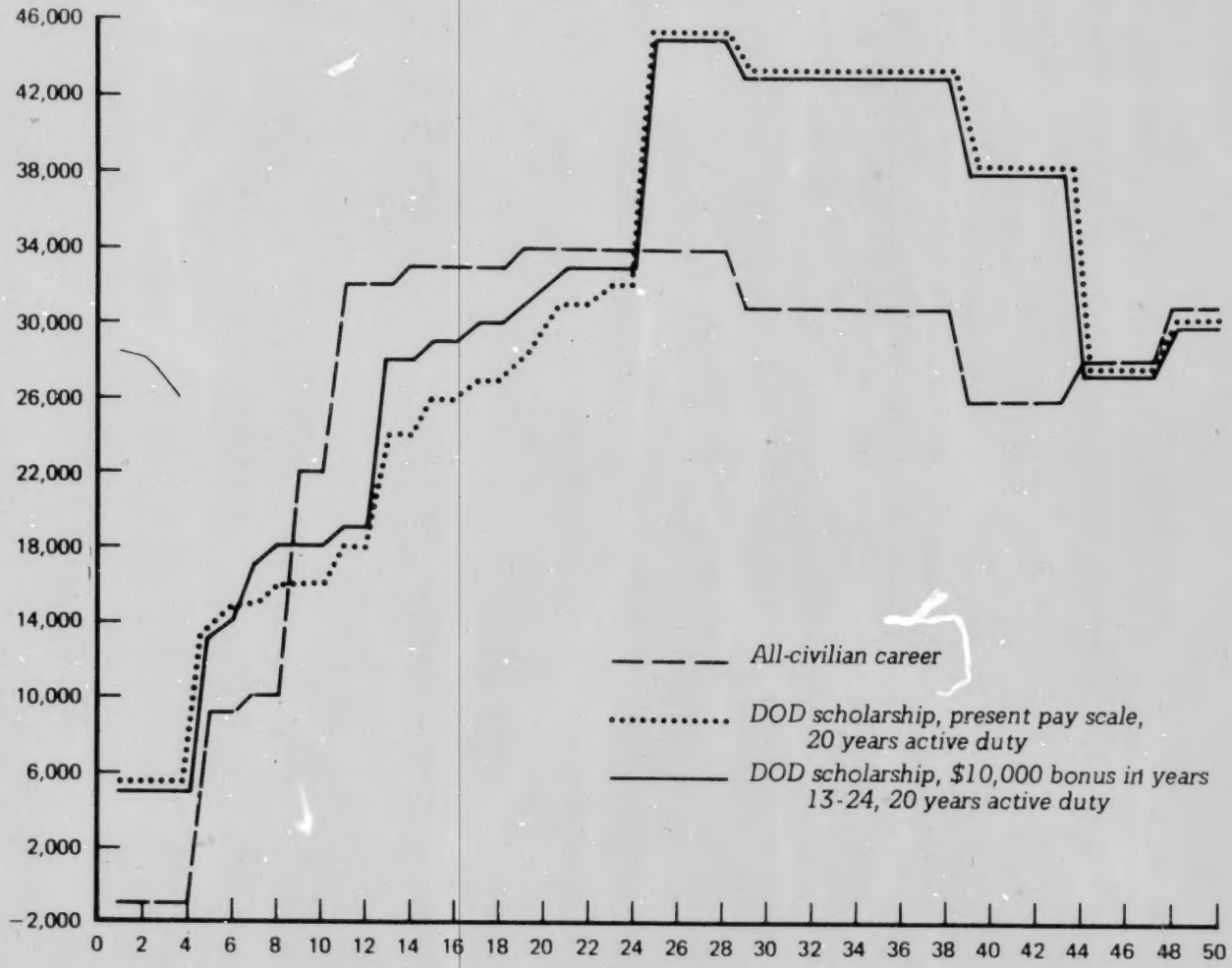

FIG. 1: AFTER-TAX INCOME PROFILES AT ENTRY INTO MEDICAL SCHOOL

Years 44 and later: These are the years of full retirement, and the income of the physician who has chosen an all-civilian career slightly exceeds that of the Navy careerist. The civilian's income consists of social security benefits and an annuity purchased with savings under the Keogh Plan. The retired Navy physician's income consists of social security benefits, Navy retirement pay, and a lesser annuity under the Keogh Plan because he has contributed for fewer years than the civilian.

1. Comparison of 20-Year Navy Career with Civilian Career.

Table 2 shows the present values at several discount rates of the three income streams on the graph, plus the additional one in which a $15,000 bonus was paid during all unobligated years. (The streams were adjusted for the probabilities of survival before the present values were calculated.) Table 3, on the next page, shows the differences between the three Navy patterns and the civilian patterns. Each of the three Navy patterns has a higher present value at all discount rates than the civilian pattern, the margin of superiority being least under the present pay system and greatest with the $15,000 bonus. The present value of Navy income (at discount rates from 5 to 10 percent) exceeds that of the civilian income by 7 to 8 percent under present pay, by 12 to 14 percent with the $10,000 bonus assumption, and by 16 to 19 percent with the $15,000 bonus assumption.

TABLE 2

PRESENT VALUES OF CIVILIAN AND NAVY CAREERS
AT ENTRY INTO MEDICAL SCHOOL

		DoD scholarship, 20-year Navy career		
Discount rates	Civilian career	Present compensation	$10,000 Bonus, years 13-24	$15,000 Bonus, years 13-24
0%	$1,408,700	$1,552,370	$1,594,042	$1,635,084
5%	384,053	410,708	429,772	446,687
6%	312,842	333,688	350,192	364,477
7%	258,257	275,393	289,735	301,831
10%	154,978	167,717	177,338	184,791

Table 3 also shows that the difference in present values between each Navy pay system and civilian income is lower at higher discount rates. Examination of figure 1 suggests why this is the case. Under any Navy compensation system, the margin of superiority is greatest during the relatively distant "second-career" years. The effect of higher income during these years on present values is diminished at higher discount rates. The medical student is 22 years old at the time of the decision and younger men are likely to have higher discount rates than older men.

TABLE 3

DIFFERENCES IN PRESENT VALUES OF 20-YEAR NAVY AND CIVILIAN CAREERS AT ENTRY INTO MEDICAL SCHOOL

	Amounts by which Navy income exceeds civilian		
Discount rate	Present compensation	$10,000 Bonus, years 13-24	$15,000 Bonus, years 13-24
0%	$143,670	$185,342	$226,384
5%	26,655	45,719	62,634
6%	20,846	37,350	51,605
7%	17,136	31,478	43,574
10%	12,739	22,360	29,813

The scholarship plan provides the Navy with the ability to offer the medical student considering a 20-year career an income of at least comparable value to what he could obtain by an all-civilian career, even under the present pay scales. Even more attractive compensation could be offered under the proposed bonus legislation.

2. Comparison of Single Navy Tour With Civilian Career.

We have seen that under present pay scales, the Navy physician's income is much lower than the civilian's during most of the active duty years beyond the residency. The higher present values associated with the Navy career are traceable to the second-career years and the early training years. Therefore, we shall reevaluate his alternatives at the end of his obligated service. But before doing so, we shall trace out the financial implications of two alternative strategies the medical student may consider from the outset. These are:

1. He contemplates accepting the DoD scholarship for the full four years, undertaking postgraduate training in the Navy, and leaving as soon as he completes his obligated service (i.e., at the end of year 12);

2. He contemplates financing the first two years of medical school himself, accepting the DoD scholarship for his junior and senior years, undertaking postgraduate training in the Navy, and leaving at the end of his obligated service (i.e., after year 10).[12]

In comparison with the all-civilian income stream, the scholarship patterns result in higher income during the years of subsidized medical school and in the four postgraduate years. This advantage is paid for by accepting lower incomes during the years of obligated service. After leaving the service, incomes are the same as for the all-civilian career.

Columns 3 and 4 of table 4 show the financial consequences of these two strategies; the present values of the all-civilian career and of the 20-year Navy career under present pay scales are repeated in columns 1 and 2 for ease of comparison. Note that the undiscounted sum associated with the civilian career is higher than for either scholarship pattern, especially the 4-year scholarship. This is because of the higher income the civilian receives during the years in which the scholarship recipients are fulfilling their obligated service. However, at all positive discount rates shown, the present values associated with either of the "in-and-out" strategies exceed those of the all-civilian career. For the 4-year scholarship, the present values are 2 to 9-1/2 percent higher and for the 2-year scholarship, they are 4 to 9 percent higher. As between the two scholarship strategies, the one with the 2-year obligation has higher present values at discount rates of 5, 6, and 7 percent, and the one with the 4-year obligation has a higher present value at 10 percent. This is because the big "losses" under the 4-year obligation occur during the last two years of obligated service, and these are more heavily discounted at 10 percent.

3. Increasing the Period of Obligated Service

While the obligated years constitute the payback period for the individual, they are likewise a period of heavy payoff for the Navy. It is obvious that lengthening this period will both increase the Navy's return on investment in the program and decrease its attractiveness to the individual.

[12] This strategy minimizes the active duty obligation, which is one year for each year in the scholarship program, with a minimum obligation of two years.

TABLE 4

PRESENT VALUES OF INITIAL TOURS COMPARED WITH CIVILIAN AND 20-YEAR NAVY CAREERS AT ENTRY INTO MEDICAL SCHOOL[a]

Discount rate	Civilian career	20-Year Navy career	DoD Scholarship: Initial tour 4-year obligation	DoD Scholarship: Initial tour 2-year obligation	DoD Scholarship: Initial tour 5-year obligation	DoD Scholarship: Initial tour 6-year obligation
0%	$1,408,700	$1,552,370	$1,355,902	$1,399,396	$1,332,580	$1,305,230
5%	384,053	410,708	392,725	399,104	385,308	377,434
6%	312,842	333,688	324,015	328,170	317,689	311,078
7%	258,257	275,393	271,095	273,531	265,636	260,013
10%	154,978	167,717	170,236	169,252	166,574	162,937

[a]Current military compensation.

Section 2123 of Public Law 92-426 states that the Secretary of Defense may not require less than one year of service for each year of participation in the program, with a minimum obligation of two years. The Secretary decided to adopt the minimum obligation imposed by law. How much could the obligation be increased and still provide the student with an income comparable to that of an all-civilian pattern?[13]

Columns 5 and 6 of table 4 show the present values associated with attaching obligations of 5 and 6 years to a 4-year scholarship for the student who plans to serve the initial tour only. If the obligation is increased to 5 years, the present value of accepting the scholarship is still higher than that of the all-civilian pattern, though barely so at a 5 percent discount rate. Under a 6-year obligation, the present value of accepting the scholarship is roughly comparable to that of the all-civilian pattern, being slightly lower at 5 and 6 percent, and slightly higher at 7 and 10 percent. In calculations not shown here, it has also been ascertained that the present value of a 20-year Navy career would remain higher than that of an all-civilian career even if the obligation were lengthened beyond 6 years.

4. Comparison of Initial Tour With 20-Year Career.

Finally, we compare a 20-year Navy career under current pay scales to the two initial-tour strategies, viz., a 2-year scholarship and service obligation and 4-year scholarship and obligation. As table 4 shows, a Navy career results in a higher undiscounted sum, largely because of retirement pay. Note that as higher discount rates are used, the amount by which the value of the Navy career exceeds that of the alternative careers decreases; at 10 percent, the present value of both initial-tour strategies exceeds that of the Navy career. This is again because of the effect of higher discount rates on income during the years after Navy retirement.

5. Discussion and Conclusions.

Our principal findings with respect to the attraction of scholarship recipients have been:

1. The present value associated with accepting a DoD scholarship and a subsequent 20-year Navy career exceeds that of the civilian pattern under each of three alternative

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[13] It has been pointed out that the service obligation required for graduates of the U. S. Naval Academy was increased from 4 to 5 years. This decision was presumably based on empirical evidence on the ratio of applicants to openings. It is relevant for us only to the extent that it suggests investigating the financial implications of lengthening the obligation period.

assumptions about military compensation. This result holds for all discount rates used in our analysis, viz., 5, 6, 7 and 10 percent. Under the least favorable assumption about military compensation, viz., the current pay scale, the present value of a Navy career is 7 to 8 percent higher than the civilian alternative.

2. The present values associated with accepting either a 2-year or a 4-year scholarship and serving only the initial obligated tour exceed the present value of an all-civilian pattern.

3. If the service obligation attached to the scholarship were increased to 5 years, the present value of serving an initial tour only would still exceed that of the all-civilian pattern. Lengthening the obligation to 6 years would result in comparable present values.

4. The present value of a 20-year Navy career under current military pay scales is higher than that of completing an initial tour only under either a 2-year or 4-year scholarship at discount rates of 5, 6, and 7 percent, and lower at 10 percent.

Experience to date does not afford a reliable guide to the long-run attractiveness of the scholarship program. As of May 1973, only seven months after the passage of the legislation, acceptances had been received for 975 (28 percent) of the 3500 medical scholarships authorized for the three services. However, many of those accepting were enrolled in early commissioning programs and already had some military obligation. The 3500 scholarships represent about 7-1/2 percent of the total enrollment in medical schools in the United States, although this percentage will decrease in the future because of increasing enrollments.

Our analyses generally indicate higher present values for career patterns involving military service than for all-civilian patterns with which they are compared. However, three factors cause us to hesitate before formulating our conclusions about the prospects for success of the scholarship program as a procurement source. The first is that the higher present values associated with a 20-year Navy career are heavily influenced by retirement pay to be received in the distant future. The second is that there is no way of knowing whether the estimated differentials will be sufficient to compensate for perceived nonmonetary disadvantages of military life. The third is that the total number of scholarships represents a nonnegligible proportion of medical school enrollment.

Our finding that the Navy is able to offer a financially attractive career pattern even to the student who intends to serve only the initial obligated tour leads us to be optimistic about the long-run drawing power of the program. This finding is not dependent upon the student's perception of what military retirement pay will be in the distant future, or the valuation placed upon that pay. Serving only an initial tour would prove financially attractive even at higher discount rates than those considered; indeed, the relative superiority of this pattern increases the higher the discount rate.

In view of this finding, ought the Secretary to have established a longer period of obligated service for scholarship recipients? We think not. Even if the income differential between Navy and civilian career patterns were held constant as the obligation period increased, we would expect a decreasing supply of applicants as the obligation is increased. The student must commit himself to a set of working conditions or way of life about which he undoubtedly has considerable uncertainty. Even with a 4-year obligation, we cannot be certain that differentials of the magnitude estimated will compensate for these nonmonetary factors. Therefore, the minimum obligation established appears to be prudent until such time as empirical evidence about the drawing power of the program has been accumulated. If this evidence indicates a considerable excess of qualified applicants, consideration can then be given to lengthening the period of obligated service.

We have assumed that most medical students and physicians will view the nonmonetary features of a military career as being less favorable on balance than those of a civilian career. For many medical students, however, the scholarship program may offer a powerful offset to these disadvantages by providing a method of financing a medical education.[14] It is well known that medical students have historically been drawn disproportionately from high income families. It is also true that the financial assistance available to these students in the form of loans and grants (other than from family sources) has not been great.[15] It is unlikely that many students from high-income families would be influenced to accept a DoD scholarship by the income differentials reported here. However, a substantial proportion of medical students do not come from high-income families; in 1967, for example, 37 percent of the medical students came from families with incomes under $10,000.[16] Some of these would surely welcome the opportunity to reduce the sacrifice in current consumption now entailed in financing a medical education. In addition, there are undoubtedly many able students who are presently deterred from choosing a medical career because of inability or unwillingness to finance a medical education and to endure the low incomes of the postgraduate training years.

It is among these two groups that the scholarship program may be expected to have the greatest appeal. We would expect the success of recruitment to increase with the length of time available to disseminate information about the scholarship program. Initial recruitment efforts have been focused primarily upon medical students. These efforts can be increasingly extended to the undergraduate level, thereby reaching that group who

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[14] See Sloan, op. cit.

[15] See Louis C. Redmund Smith and Anna R. Crocker, How Medical Students Finance Their Education, National Institute of Health, U. S. Department of Health, Education, and Welfare, Washington, D. C.: U. S. Government Printing Office, January 1970.

[16] Ibid., p. 8.

would have been dissuaded from choosing a medical career because of the cost. The scholarship program may well have appeal among this group even if the present value of becoming a military physician were lower than that of a civilian medical career, for it could still exceed the present value of the best alternative nonmedical career.

It is also the case that the degree of aversion to the nonmonetary features of a military career will not be uniform. Some physicians prefer a military career, even at lower compensation than available in the civilian sector, that is, they view the nonmonetary features of military life favorably, on balance. Others will be indifferent at equal compensation levels, and others will require premiums of various sizes to induce them into military service. DoD seeks to attract about 7-1/2 percent of the current medical school enrollment into the program. This may be possible even if the great majority of present and prospective medical students regard the nonmonetary aspects of military life unfavorably.

Our conclusion is that the DoD scholarship program will prove to be sufficiently attractive to fill the 3500 medical scholarships currently authorized and to keep them filled, given sufficient time to disseminate information to prospects.

B. Retention of the Scholarship Recipient

1. Analysis.

The scholarship recipient will have completed 8 years of active duty by the end of his obligated service under our assumption of 4 years of postgraduate medical training in the military. Regardless of how he may have evaluated the attractiveness of a military career when he entered the program, he will reevaluate his alternatives at this time. We compared the present value of the lifetime income he could receive if he entered civilian practice at this time with that of completing a 20-year active duty career, using three different assumptions about military compensation.

The sequence of income over time for the first three streams is that shown in figure 1 from year 13 onward, with one exception. If the physician leaves the Navy, his civilian income during the retirement years (years 44 on) will be about $5000 per year less than the civilian stream shown on the graph. This is because he did not contribute to a Keogh Plan for as many years as did the civilian, hence his annuity will be smaller upon retirement. Table 5 shows the present values of these streams and table 6 shows the differences in present values between the three Navy patterns and the civilian pattern.

Under current pay, the present value of remaining in the Navy exceeds that of leaving at discount rates of 5, 6, and 7 percent, although the differences are fairly small, with the Navy stream 3 to 6 percent higher, depending on the discount rate. At a 10 percent discount rate, the present value of leaving the Navy is greater than that of remaining.

Inspection of figure 1 and table A-15 (appendix A, columns 9 and 12) indicate why this is so. The higher present value of the Navy income stream is solely due to the higher income in the second-career years; during most of the remaining years of active duty, Navy income is substantially below civilian income, even with the addition of continuation pay. It is likely that many physicians will have entered the program with plans to leave as soon as their obligation is fulfilled. Reevaluation of the alternatives at this point will not dissuade them.

TABLE 5

PRESENT VALUES OF CIVILIAN AND 20-YEAR NAVY CAREERS AT END OF OBLIGATED SERVICE

		20-Year Navy career		
Discount rate	Civilian career	Present compensation	$10,000 Bonus remaining years	$15,000 Bonus remaining years
0%	$1,209,853	$1,407,382	$1,438,043	$1,479,085
5%	525,297	558,642	580,353	610,731
6%	464,055	484,568	504,925	533,670
7%	414,245	424,974	444,086	471,328
10%	309,899	303,043	318,983	342,374

The financial alternatives confronting the scholarship recipient at his first decision point will be similar to those confronting a Navy physician today who has completed all obligated service and has about 8 years of active duty. Therefore, we attempted to examine the historical response to continuation pay since it was introduced in 1968 in the hope that it would help us to estimate retention under current military compensation. This experience is summarized in table 7 for physicians in the grade of 0-4.

The acceptance rates shown are surprisingly high, and on their face they do not suggest any serious retention problem under present military salaries. The acceptance rates for all grades are even higher (76 percent for both DoD and the Navy in 1972), of course, because of the greater percentage of acceptance by physicians above grade 0-4. However, these acceptance rates are misleading.

TABLE 6

DIFFERENCES IN PRESENT VALUES OF 20-YEAR NAVY AND CIVILIAN CAREERS AT END OF OBLIGATED SERVICE

Discount rates	Amounts by which Navy income exceeds civilian: Present compensation	$10,000 Bonus remaining years	$15,000 Bonus remaining years
0%	$197,529	$228,190	$269,232
5%	33,345	55,056	85,434
6%	20,513	40,870	69,615
7%	10,729	29,841	57,083
10%	-6,856	9,084	32,475

TABLE 7

ACCEPTANCE OF CONTINUATION PAY BY MILITARY PHYSICIANS IN GRADE 0-4

Calendar year	DoD: Number offered	DoD: Number accepted	DoD: Percent accepted	Navy: Number offered	Navy: Number accepted	Navy: Percent accepted
1968	354	131	37	--	--	--
1969	295	140	48	--	--	--
1970	1817	825	45	--	--	--
1971	2076	927	45	628	260	41
1972	1538	808	53	520	282	54

SOURCE: Office of the Assistant Secretary of Defense (Health and Environment)

The conditions under which a physician is eligible to receive continuation pay are set forth in appendix A. In the original version of this part of the study, we seriously misinterpreted one of these conditions. This led us to estimate retention rates of approximately 45-55 percent under present military pay, and higher rates under annual bonuses of $10,000 and $15,000. Our examination of DoD Directive Number 1340.8, and Section 311, Title 37, U.S. Code, and Section 10515 of the Military Pay and Allowances Entitlement Manual, led us to conclude that one of the conditions of eligibility for continuation pay was completion of all previous obligated service. Actually, the condition is that the physician must have completed his initial active duty obligation; under conscription, this is generally a period of two years. Another condition, which we did not misinterpret, is that the physician must have completed five years of service. (Time spent in civilian residency programs is counted toward fulfillment of this requirement.)

Now consider the case of a physician who enters service after internship and serves his two-year obligation as a general medical officer. He then accepts a three-year Navy residency. (As we have seen, his income during Navy residency training is substantially higher than it would be if he entered a civilian residency program.) When he finishes his residency he will have five years of service and will have met the other criteria for continuation pay. He also will have incurred a three-year service obligation. By agreeing to extend for one additional year of active duty, he may receive continuation pay for all four years, including the three which he would have had to serve in any event. This continuation pay will be approximately $4500 per year. We have been informed that the high acceptance rates shown in table 7 are heavily influenced by acceptances of this sort.[17] We have also been informed that the Navy estimates an acceptance rate of only 11-1/2 percent for O-4's in 1973, with approximately 67 acceptances from 584 selectees. The reasons for this decrease are not clear. The continuation pay data as presented in table 7, therefore, are not very useful for understanding current retention experience, much less as a guide for estimating the future retention of scholarship recipients.

Detailed data on experience with continuation pay are potentially a valuable source of information, but unfortunately they are not readily available. It would be useful to examine acceptances and rejections by (1) specialty; (2) length of active duty; and (3) remaining obligated service at the time continuation pay was offered. Analysis of these data could:

(1) enable us better to interpret current response to continuation pay;

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[17] We are indebted to representatives of the Bureau of Medicine and Surgery who called our attention to this misinterpretation during a briefing we presented to the Surgeon General on 17 August 1973.

(2) enable us to estimate the retention of scholarship recipients in the future, both under present military pay and under the bonus legislation;

(3) provide guidance in administering the bonus legislation, i.e., in deciding upon the amounts to be offered for different specialties.

An 0-4 may have completed varying amounts of active duty at the time he becomes eligible for continuation pay, ranging upward from two years. This can be true even for those who have completed all obligated service. We should like to examine acceptances and rejections by those who have little or no obligated service at the time of the offer. If there were enough in each category, we could see whether rejections are heavily concentrated among those with relatively few years of active duty and acceptances among those with longer service. The scholarship recipient who undertakes a military internship and residency would complete both his initial active duty obligation and his total obligation after 8 years of active duty. Therefore, it would be particularly useful to examine acceptances and rejections by unobligated physicians with approximately eight years of active duty as a guide to the retention behavior of scholarship recipients in the future.

A major shortcoming of the civilian earnings data used in this report is that we do not have earnings-experience profiles for individual specialties, but only for all specialties combined. There are some data on median earnings by specialty (although not by years of experience), and these show considerable variation among specialties. Accordingly, the financial attractiveness of a Navy career will differ among specialties. Examination of acceptances and rejections of continuation pay by unobligated specialists would provide guidance for the administration of the bonus, that is, for the amounts to be offered for different specialties.

We next examine the scholarship recipient's alternatives at the end of his obligation under the assumption that a $10,000 bonus would be paid during each of the 12 remaining years of service. Figure 1 shows that this would reduce the difference between the civilian and military physicians' income during these years. During the first seven of these years (years 13-19) the civilian after-tax income exceeds that of the military by about $3000, and this difference is virtually eliminated during the last five years of active duty. Tables 5 and 6 show that the present value of the Navy income stream now exceeds that of the civilian stream at all discount rates from 5 to 10 percent. Once again, these differences are lower the higher the discount rate employed, because the superiority of the Navy alternative depends heavily upon future retirement pay, which is more heavily discounted the higher the rate employed. The present value of the Navy alternative ranges from 10-1/2 percent higher than the civilian (at a 5 percent discount rate) to 3 percent higher (at a 10 percent discount rate).

The payment of a $15,000 bonus for all unobligated years is not shown in figure 1, but if paid, Navy income would almost match civilian income from the outset (year 13) and somewhat exceed it during most of the active duty years. Tables 5 and 6 reflect this. The present value of the Navy alternative now substantially exceeds that of the civilian at all discount rates employed, with the present values being 10-1/2 percent greater at a 10 percent discount rate and 16 percent higher at a 5 percent discount rate.

Our discussion of the retention of scholarship recipients is also applicable to present unobligated Navy physicians who have about 8 years of service at the time the bonus legislation is enacted. The present values shown in tables 5 and 6 would be approximately the same for these physicians, as would the income streams shown in figure 1 from year 13 onward.

2. Conclusions

The discussion of retention in this section has been from the point of view of financial attractiveness to the physician, not to the Navy. Whether and to what extent it pays the Navy to retain physicians for a 20-year career is discussed in Section V. Our emphasis is on retention of medical scholarship recipients because we expect this program to be the primary source of accessions in the future, however, the discussion has applicability to current Navy physicians.

The most optimistic conclusion one can arrive at with respect to retention under present military compensation is that it does not enable the Navy to offer the scholarship recipient any significant financial advantage to remain, even though he has completed 8 years of active duty. The same conclusion applies to physicians who currently have about 8 years of active duty, and for those with less there is a strong financial incentive to leave. Earnings comparisons show that the present value of a Navy career at the 8-year point is slightly greater at lower discount rates and the present value of a civilian career is slightly greater at higher discount rates. This reflects the fact that Navy income is lower during all remaining active duty years, and substantially lower during the early years.

Even for those with low discount rates (i.e., those who place a relatively high value on future retirement pay), the financial advantage of a Navy career is slight. The scholarship recipient at this point is relatively young (about 33 or 34), and is likely to have a relatively high discount rate. Moreover, the present compensation structure does not enable the Navy to compensate for any perceived nonpecuniary disadvantages of military life, nor to be selective about which physicians it retains.

We attempted to examine the historical response to continuation pay as a guide to the future retention of scholarship recipients, but the data in table 7 are too higher aggregated to be of use for this purpose. Also, data recently provided by BuMed indicate much lower acceptance rates for 1973.

Of course, some physicians would remain in the Navy under current compensation, even as some do today. These would be primarily individuals who have a preference for military life. Our procedure does not enable us to estimate how many would remain, nor can we specify the number the Navy should seek to retain. We do conclude that a Navy career will not be financially attractive to the scholarship recipient, even though he will have completed 8 years at the end of his obligated service. Present compensation is even less adequate as a retention incentive for physicians with fewer years of service.

The bonus legislation would enable the Navy to offer the scholarship recipient a financially attractive career. The present value of remaining in the Navy after 8 years of service would be 3 to 10 percent higher than that of a civilian career (depending on the discount rate) if a $10,000 bonus were offered during the remaining active duty years. The Navy physician's income would still be lower than the civilian's during the active duty years, but the differential would be considerably less than under present pay. If a $15,000 bonus were offered during all remaining years, the present value of a Navy career would be 10 to 16 percent higher than that of a civilian career. Moreover, Navy income would match or exceed civilian income during the remaining active duty years.

These same conclusions are applicable to current Navy physicians who have about 8 years of service at the time the legislation is passed. Indeed, regardless of length of service, payment of a $15,000 bonus would result in higher present values of a Navy career than of a civilian career, as can be seen from the analysis of the following section and the income data in table A-15 (appendix A). Moreover, income during the active duty years would be comparable to or greater than the average civilian income. The financial advantage of remaining in the Navy will not be as great as shown in table 5 and 6 for those with less than 8 years of service when the legislation is passed, and it will be greater for those with more than 8 years of service at that time. If an increase in retention is desired, the bonus legislation appears to offer a means of quickly achieving this.

We conclude that the bonus legislation would enable the Navy to offer a financially attractive retention incentive not only to scholarship recipients at the end of obligated service, but also to many physicians now serving who would otherwise leave. The legislation should enable the Navy to attain reasonable overall retention goals, although there may still be difficulties in a few specialties.

C. Attraction of Post-Residents

1. Analysis.

Next we consider whether the Navy could offer a financially attractive career to a 30-year old physician who has just completed a one-year internship and a 3-year residency in the civilian sector at his own expense. We consider his choice between a civilian career, and a 20-year Navy career under three alternative assumptions about military

pay: (1) the present pay system, under which he begins to receive continuation pay after completion of two years of active duty; (2) payment of a $10,000 bonus for all 20 years of active duty; and (3) payment of a $15,000 bonus for all 20 years of active duty. He is commissioned as an 0-4 with 8 years of service credited for pay purposes. We again assume that he retires after 20 years and pursues a civilian career until age 65, during which time he is able to receive the same income as his civilian counterpart.

Three of the income streams are shown on the graph of figure 2. If the physician entered the military under the present pay scales, his income would be well below the civilian's during most of his active duty years. The differential decreases over time and his income matches the civilian's during the last two years of active duty. During the second-career years, his income exceeds the civilian's by the amount of his retirement pay. In the years of full retirement, his income will be below the civilian's because of the latter's long period of Keogh Plan contributions.

The payment of a $10,000 bonus results in an income well below the civilian level during most of the early years of active duty (but to a lesser extent than present pay) and about the same as the civilian income during the last eight years of active duty. The pattern during the second-career and full-retirement years is identical with that under the present pay scale. Payment of a $15,000 bonus would result in a military income comparable to that of the civilian income during the first 10 years of active duty, and exceeding it during the last 10 years.

Table 8 shows the present values associated with these income profiles. Under current pay, the present value of a Navy career is lower than that of a civilian career at all discount rates from 5 to 10 percent. The differential is greater at higher discount rates because of their effect on military retirement pay to be received in the distant future.

A comparison of the $10,000 bonus with the civilian profile shows that the Navy career has a higher present value at discount rates lower than about 6-1/2 percent and a lower present value at rates above this. This again reflects the sensitivity of retirement pay to the discount rate. Payment of a $15,000 bonus, on the other hand, results in a higher present value for a Navy career at all discount rates from 5 to 10 percent; Navy income would be from 7 to 10 percent higher than civilian income.

2. Conclusions.

Comparison of the civilian career with a Navy career under current pay scales leads us to a conclusion already well known, namely, that very few fully-trained physicians will enter the military in the absence of consciption. Under the $10,000 bonus, the present values of the Navy and civilian careers are roughly comparable, but the Navy career would only appeal to those placing a high value on retirement pay (i.e., having low

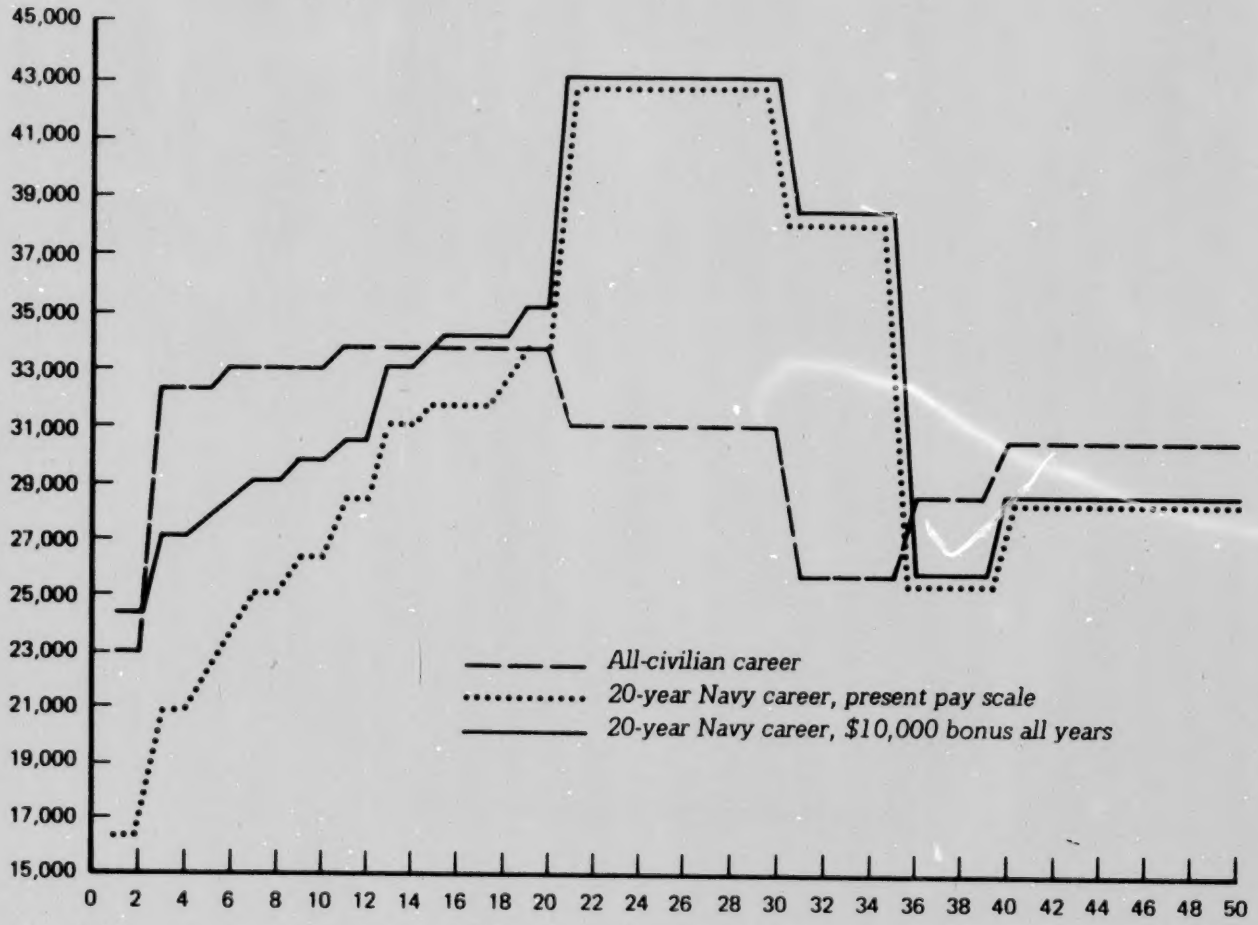

FIG. 2: AFTER-TAX INCOME PROFILES AT COMPLETION OF CIVILIAN RESIDENCY

discount rates). We would not expect many volunteers at this compensation level, except perhaps in some of the specialties with incomes below the civilian median.

TABLE 8

PRESENT VALUES OF CIVILIAN AND 20-YEAR NAVY CAREERS AT COMPLETION OF CIVILIAN RESIDENCY

		20-Year Navy career		
Discount rates	Civilian career	Present compensation	$10,000 Bonus, 20 years	$15,000 Bonus, 20 years
0%	$1,380,604	$1,401,468	$1,471,754	$1,540,423
5%	536,537	497,543	546,264	589,384
6%	467,240	424,702	470,459	510,203
7%	411,873	367,194	410,295	447,055
10%	299,013	253,111	289,709	319,367

Payment of the $15,000 bonus results in a Navy income which is 7 to 10 percent above the civilian average, and it is likely that a bonus of about this size would have to be paid to attract any appreciable number of fully-trained physicians. If extended to all specialties, which appears unlikely, many of those attracted would no doubt be in the lower-income specialties.

We are unable to estimate whether many full-trained physicians would be attracted even with the maximum bonus, especially those with specialty incomes at or above the civilian median. In the profile we used for our comparisons, the civilian would be 30 years old; actually, many would be older and few would be younger. We conjecture that a physician who has spent this much of his adult life as a civilian would weigh the non-monetary disadvantages of military life more heavily than a younger man. That is, it would take a higher differential to attract him to the military. In the case of the medical student, the Navy has the advantage of being able to offer a means of financing a medical education, which the student might otherwise find difficult or impossible to do. There is no such advantage in the case of the fully-trained physician. Moreover, after the scholarship program has been in operation for a number of years, we would expect fully-trained physicians to be a less likely source of procurement. Many of those with a preference for (or the least aversion to) military life would already have entered this program.

V. THE SCHOLARSHIP PROGRAM AS AN INVESTMENT

In the preceding section, we investigated the attractiveness of a Navy career from the point of view of the medical student or physician. We concluded that the Navy would be able to attract physicians through the scholarship program. We also concluded that the bonus legislation would enable the Navy to offer a financially attractive retention incentive to scholarship recipients at the end of obligated service and also to many present Navy physicians. Present compensation does not provide a strong retention incentive.

In this section, we view the scholarship program as an investment by the Navy. The rationale is that by investing in medical education the Navy will be able to secure physicians' services in the future at a lower price than procurement through other methods would entail. This is essentially a "make-or-buy" decision; that is, it is a decision about whether it pays the Navy to train its own physicians (in this case, to pay for their training in the private sector), or to buy the services of physicians who have already been trained. Our purpose is to evaluate this investment. We want to ascertain whether the cost outlays in the early years of the scholarship program are justified by the savings in the later years, in comparison with alternative methods of procurement. We also want to ascertain whether it pays the Navy to retain a scholarship recipient for a 20-year career.

The three major types of comparisons made in this section are:

(1) The scholarship plan is compared with using a civilian contract physician to provide medical services;

(2) The scholarship plan is compared with attracting a fully-trained physician into military service by offering a direct commission and a bonus;

(3) Retention of a scholarship recipient for a 20-year career is compared with utilizing a succession of scholarship recipients who remain only for the initial obligated tour.

It may be noted that one set of alternatives we did not compare directly is the use of civilian physicians with attracting post-residents into the military. We have argued elsewhere that the Navy would probably have to pay a premium to attract a fully-trained physician into military service compared with hiring a civilian, and that it would be preferable to hire civilians to the extent that the military mission permits. It also appears that either of these alternatives is generally inferior to the scholarship program as a source of procurement, as will be shown below.

We calculated the Navy's return on investment for 10 different pairs of alternatives. (These alternatives and the results of our calculations are summarized in table 10.) One's views about the attractiveness of any given investment will depend upon what he considers to be the appropriate rate of return on Navy investment. Therefore, if one

agrees with our method and assumptions, he can easily formulate his own conclusion based upon our findings. We have stated our conclusions during the discussion of each of the comparisons made and summarized them in the final section.

A. Method of Evaluating the Navy's Investment

1. Estimating the Stream of Differences

We shall now explain the way in which we evaluated the alternatives, using a comparison of the scholarship plan and civilian contract physicians as our main example. First, we estimated the outlays which the Navy would have to make over the years in order to receive comparable services under each alternative. Next, we calculated the differences between these outlay streams. Then we estimated the rate of return to the Navy on its investment in the scholarship program, and also the present value of the investment at 10 percent. The economic interpretation of the rate of return is discussed in the following section.

There are different ways of hiring civilians; we have assumed that the Navy contracts for civilian physicians, paying them the median net income from practice (all specialties) received by self-employed physicians in 1973, namely, $44,000 per year. (This could also represent payments to a succession of civilian contractors, rather than to a single individual.) This is the Navy's only expenditure; the physician pays his own social security taxes and purchases his own "fringe benefits". Alternatively, we could have assumed that the Navy hires physicians as employees under Civil Service. This would entail estimating a promotion profile, the cost of fringe benefits, and the pension, in parallel fashion to our estimates for the military physician. We did not do this because we have doubts about the Navy's ability to attract sufficient numbers of well-qualified civilians under the present Civil Service pay scales. However, as we discuss in appendix C, it may be possible to hire an appreciable number of civilian physicians under a revised compensation system. Some of our results suggest that this possibility should be analyzed, but we have not had time to do so.

For the scholarship recipient, the Navy's outlay consists of the stipends, tuition, and other expenses paid during the medical school years, base pay, allowances and special pays during the active duty years, social security taxes paid by the Navy during these years, and retirement pay if the physician remains until retirement. Pay is included gross of taxes and social security taxes are added because these items are charged against the Navy's budget. The retirement pay stream is adjusted by the mortality probabilities, beginning at the age of retirement.

We did not assign any cost of non-cash benefits, because the marginal cost of providing these benefits to this fraction of the Navy population is small and very difficult to estimate. We also did not allow for recruitment costs, accession, rotation, and separation costs, benefits to survivors of those who die on active duty, dropouts from medical

school or prior to the completion of obligated service, or disability retirement prior to completion of obligated service. The effect of all of these is to overstate the Navy's return on investment.

Table 9 summarizes the nature of the differences in the Navy outlay streams for three of the comparisons made. In each case, annual outlays under the scholarship pattern are subtracted from those under the alternative procurement method with which it is compared. We shall first discuss the differences between the outlays for a scholarship recipient who leaves after the initial tour and those for a civilian contract physician.

TABLE 9

COSTS (-) AND RETURNS (+) TO THE NAVY OVER TIME
FOR THREE SETS OF ALTERNATIVES

Alternative	Years					
Scholarship program (initial tour) vs. civilian	1-4	5-8	9-12			
	--	0	++			
Scholarship program (20-year career) vs. civilian	1-4	5-8	9-12	15-19	20-24	25-
	--	0	++	+	-	--
Scholarship program (20-year career) vs. post-resident	1-4	5-8	9-12	13-25	26-	
	--	0	++	+	-	

NOTE: Double signs indicate heavily negative or positive differences. Current level of military compensation assumed.

During the first four years when the scholarship recipient is in medical school, the Navy is making outlays and receiving no services in return. It is assumed that the civilian physician does not come aboard until the fifth year. Therefore, we subtract the outlays on the scholarship recipient during these years from zero, and enter negative items in the stream of differences.

During the second four years, the individual is undertaking a military internship and residency; he is receiving training, but at the same time he is rendering valuable services. He is also receiving pay and allowances substantially greater than the stipends received by civilian interns and residents. There has been considerable debate about the value of interns and residents. Attempts to estimate their value in the civilian sector by the use of regression techniques are unpersuasive because of arbitrary allocations of costs and revenues associated with their employment. The evidence from the civilian

market does indicate rather clearly that the value of their services is greater than their stipends. This is not a competitive market, and each year the number of openings for interns and residents (quantity demanded) substantially exceeds the number available (quantity supplied) at the prevailing stipends. But while it is clear that they are worth more than they receive in stipends, we do not know how much more. Therefore, we have assumed that their services are worth what the Navy pays for them, in lieu of any better assumption. The fully-trained civilian contract physician begins employment in year 5. It is also assumed that he performs services equal in value to what the Navy pays him. Thus, a Navy intern or resident receives roughly 40 percent of the payment to a fully-trained civilian during these years, and we assume that he is about 40 percent as productive. Therefore, the difference between these streams during these years is entered at zero.

During the years of obligated service, the Navy physician's pay will be well below the civilian's under any of our three assumptions about military compensation. Therefore, the difference between these streams is entered as a positive item during these years. This is a period of substantial return on investment for the Navy; from the physician's point of view, these are the years during which he repays the Navy for the subsidy received earlier.

At this point we estimate the rate-of-return in order to ascertain whether it pays the Navy to invest in a scholarship if the man leaves as soon as he has completed his obligated service.

On the other hand, he may remain on active duty for a 20-year career, and so we can continue to estimate the differences in the two streams. (This is the second set of alternatives outlined in table 9.) These will now vary considerably, depending upon the military compensation system postulated. Under the present pay system, the payoff to the Navy continues to be positive during the active duty years up to the 20th year, and is fairly large during the earlier years. Under the assumption of payment of a $15,000 bonus for all unobligated years, the payoff is negative during the last five years of active duty (i.e., the military physician receives more than the civilian median), and the positive payoff is smaller during the preceding years of unobligated service.

Whatever the pay system in effect, the amounts entered after retirement are negative because of the outlay for military retirement pay during years when no services are received in return. There is no corresponding retirement pay outlay for the civilian contract physician.

The third set of alternatives outlined in table 9 shows the differences in the outlay streams for a scholarship recipient and a fully-trained physician receiving a direct commission. The differences are again negative during the years of medical school, zero during internship and residency, and positive during the period of obligated service. In

the remaining active-duty years, relatively small positive items enter the stream of differences. The physician who received the direct commission receives higher pay during these years because he entered with a higher rank and greater number of years of service for pay purposes. Although his retirement will be slightly higher than that of the scholarship recipient, small negative amounts are entered during these years. This occurs because the directly-commissioned physician is older than the scholarship recipient upon retirement and the survival probabilities are therefore lower.

2. Calculation and Interpretation of the Rate of Return

If there existed some discount rate (or rate of return) widely agreed to be appropriate for Navy investments, we could simply discount a stream of differences at that given rate. The decision rule would be to undertake any investment which has a positive present value at that rate. The first comparison summarized in table 10 is between a scholarship recipient who serves only one tour and the use of a civilian contractor. If 10 percent were the appropriate discount rate for the Navy, the present value of investing in the scholarship program would be $7133 per man, and the investment should be undertaken.

Unfortunately, there is no such rate; in this situation, the rate of return over cost is a useful tool. This rate is defined as the rate which sets the present value of the differences between two streams equal to zero.[18] Table 10 shows that the rate of return over cost on the investment discussed above is 13.1 percent. The interpretation of this rate is that the return on the Navy's investment in the scholarship program is 13.1 percent per year on the average, in comparison with the alternative specified. This rate is also known as the crossover rate, because at all discount rates lower than 13.1 percent the investment has a positive present value, while at all higher discount rates the present value is negative. Therefore, one would reject the above investment only if he thought the Navy should get a greater return than 13.1 percent on its investments; if any lower rate were thought appropriate, the investment should be undertaken.

Table 9 shows that the sequence of differences for the comparison just discussed is negative, zero, and positive. Only one alternation of sign (between negative and positive)

[18] This rate is similar, but not identical, to the internal rate of return, which sets the present value of a single stream equal to zero. The rate of return over cost is appropriate for mutually exclusive investment alternatives. For a discussion of these concepts and the difference between them, see Armen A. Alchian, "The Rate of Interest, Fisher's Rate of Return Over Costs and Keynes' Internal Rate of Return," American Economic Review, December 1955.

occurs. In this case, the rate of return over cost is unique. The second case in table 9 shows the nature of the differences between investment in a scholarship and subsequent 20-year career and the use of a civilian contractor. The sequence of the differences between the streams is negative, zero, positive, and negative. (The last negative items represent military retirement pay.) In this case, there are two reversals of sign, and there may be as many crossover rates as there are sign reversals.[19]

Table 10 (comparison 3) shows that there are two crossover rates in this case, viz., 5.2 percent and 17.6 percent. That is, both set the present value of the stream of differences equal to zero, and there is no basis for asserting that one of these rates is more "correct" than the other. This complicates interpretation, but we believe the concept is still useful. At all discount rates between 5.2 percent and 17.6 percent, investment in the scholarship program has a positive present value. At all rates below 5.2 percent and above 17.6 percent, the investment has a negative present value. Although one can no longer unambiguously specify the Navy's rate of return on the investment, if he believes that the appropriate rate lies anywhere within the above range he will conclude that the investment should be undertaken.

Further explanation may be useful in understanding why there are two rates which set the present value of the stream of differences equal to zero in this case, and in interpreting the results. Any given sum will have a higher present value: (1) the earlier it occurs in the time sequence; and (2) the lower the discount rate. In this case, the early net outlays during the medical school years receive heavy weight in the present value calculations at high discount rates compared to positive and negative items occurring later. Therefore, at high discount rates (over 17.6 percent), the present value is negative. On the other hand, the large net outlays during the retirement years receive heavy weight at low discount rates. Therefore, at low discount rates (below 5.2 percent), the present value is also negative. It is only in the intermediate range of rates that the positive returns during the active duty years dominate the present value calculations.

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[19] The rate of return over cost is that rate, r, which solves our equation, which is of the following form:

$$0 = \frac{-C_1}{(1+r)} + \frac{-C_2}{(1+r)^2} + \ldots + \frac{B_9}{(1+r)^9} + \frac{B_{10}}{(1+r)^{10}} + \ldots + \frac{-C_{21}}{(1+r)^{21}} + \ldots + \frac{C_n}{(1+r)^n} \quad ,$$

where the negative items (C) represent net outlays during a year, the positive items (B) represent net returns, and the numerical subscripts in the numerators and exponents in the denominators correspond to the years in the sequence. That is, r is the rate which sets the present value of the sequence equal to zero. According to Descartes' rule of signs, such an equation has at most as many roots (solving rates) as there are alternations of sign in the sequence of terms on the right-hand side.

TABLE 10

COMPARISON OF INVESTMENT IN THE SCHOLARSHIP PROGRAM AND ALTERNATIVE METHODS OF PROCURING PHYSICIANS: RATES OF RETURN TO THE NAVY AND PRESENT VALUES AT 10 PERCENT

Comparison	Military compensation system[a]	Length of obligated service beyond residency	Length of active duty[b]	Alternative	Present values at 10 percent	Rates of return (crossover rates)
1.	Present	4 years	8 years	Civilian contractor	7,133	13.1%
2.	Present	2 years	6 years	Civilian contractor	9,070	18.8
3.	Present	4 years	20 years	Civilian contractor	15,520	5.2 and 17.6
4.	$10,000 bonus	4 years	20 years	Civilian contractor	3,627	7.8 and 14.1
5.	$15,000 bonus	4 years	20 years	Civilian contractor	−7,228	–
6.	$15,000 bonus	6 years	20 years	Civilian contractor	1,057	9.2 and 13.4
7.	$15,000 bonus, 2 percent annual growth in base pay	4 years	20 years	Civilian contractor, 2 percent annual growth in income	25,601	4.0 and 19.8
8.	$10,000 bonus	4 years	20 years	Direct commission to post-resident	−5,208	1.2 and 7.4
9.	$15,000 bonus	4 years	20 years	Direct commission to post-resident	2,186	0 and 10.9
10.	Present[c]	4 years	20 years	Succession of 4 scholarship recipients, initial tour only[c]	2,084[c]	10.4[c]

[a]Present military retirement system assumed for all 20-year Navy careers.
[b]Including a one-year military internship and a 3-year military residency in all cases.
[c]In this comparison the alternative of a succession of scholarship recipients constitutes the investment; the rate of return and present value pertain to investments in the succession of scholarship recipients.

Indeed, in the case we are discussing, the scholarship program cannot be unambiguously classified as an investment, although we shall continue to use that term for convenience. The meaning of investment is to incur a current sacrifice (costs, or negative items) in order to realize future gains (benefits, or positive items). To invest is to choose a "later" stream over an "earlier" one; in order for one alternative to be unambiguously later than another, the sequence of differences would have to contain all nonpositive differences with at least one negative difference up to a certain date, and thereafter all nonnegative differences with at least one positive difference. Thus, in the first comparison discussed above (civilian and scholarship with initial tour only), the scholarship could be unambiguously classified as an investment, but not in the second comparison.

In the usual cases of investment in physical or human capital, such as building a factory or attending college instead of entering the labor market after high school, there is a sequence of costs (negative) in the early years, followed by a sequence of returns (positive) in the later years as the higher incomes resulting from the investment are

realized. Because of the military retirement system, sign reversals and multiple rates of return will be characteristic of an entire class of military manpower problems, namely, those involving a choice between the use of contractors and military personnel.[20]

3. Comparison No. 1

The results of the 10 pairs of comparisons analyzed are summarized in table 10 and the actual streams of differences are presented in table A-16 (appendix A). The subheadings used in discussing our results are keyed to the summary in table 10.

The first comparison summarized in the table is between the civilian contractor and the medical student who accepts a 4-year scholarship, 4 years of military postgraduate training, and leaves after fulfilling a 4-year active duty obligation. The present military pay scale is assumed. The analysis in the preceding section indicated that this would be a financially sound strategy for the student compared with financing his own medical education. We now ask whether this would be a good investment for the Navy compared with paying a civilian contract physician $44,000 to provide medical services during the years the Navy physician would be on active duty.

During the four years of medical school, the Navy's net outlay is about $9000 per year. The difference between the two outlay streams in the four postgraduate years is zero, according to our assumption. During the last 4 years of this comparison, the Navy is realizing a return on its investment of about $23,000 to $25,000 per year. This is the difference between what it pays the scholarship recipient during his 4-year obligated term and the $44,000 it would have to pay to the civilian contractor.[21]

Do these returns, to be received 9 to 12 years in the future, justify the outlay made during the first 4 years? Table 10 shows that the rate of return over cost on the investment is 13.1 percent. Unless one believes that the Navy should receive a higher return than this on its investments, he would conclude that it should be undertaken. Our own judgment is that the scholarship program is a worthwhile investment in this case, even though the man leaves the Navy after four years of service as a post-resident.

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[20] In this discussion, we have drawn on J. Hirshleifer, Investment, Interest and Capital, Englewood Cliffs, N.J.: Prentice-Hall, 1970, pp. 48-54.

[21] Military compensation would be only slightly higher during these years under the bonus legislation. The scholarship recipient would not be receiving a bonus during these years, and the only difference is that the special pay would be higher.

4. Comparison No. 2

The second case to be analyzed is that of the medical student who accepts a scholarship for the last two years of medical school, undertakes four years of postgraduate training in the Navy, and then leaves after completing a 2-year obligation. The comparison is again with the use of a civilian contractor at $44,000 per year during the active duty years, and the present military compensation scale is assumed. The analysis in the preceding section also showed that this pattern would pay the individual in comparison with financing his own education.

Table 10 shows that even with such a short payoff period, the rate of return over cost is 18.8 percent, and the present value of the stream of differences discounted at 10 percent is $9070. It is interesting that this pattern has a higher rate of return than the preceding one, even though there are two fewer years of obligated service during which the Navy can realize the relatively high returns. The reason is twofold: (1) the additional two years would occur at the end of the stream, and hence be most affected by discounting; and (2) the Navy has two fewer years of outlay early in the stream, and these negative items are least affected by discounting.

There seems little question that 18.8 percent is a high rate of return by virtually any standards, and we conclude that it pays the Navy to offer the scholarship for the last two years of medical school in comparison with the civilian alternative. One might also conclude that the Navy should attempt to fill as many scholarships as possible with third and fourth year medical students. However, we have not taken into account the additional accession and separation costs such a policy would entail, and the conclusion may be reversed if this were done. The conclusion is also sensitive to our assumption about the value of interns and residents.

5. Comparison No. 3

The third comparison shown in table 10 is between the use of a civilian contract physician over a period of 20 years and the recipient of a 4-year scholarship who remains on active duty for 20 years. The present military pay scale is assumed. This is the case used to illustrate our discussion of the rate of return above. As noted, the stream of differences between these two patterns is negative during the medical school years, zero during the postgraduate years, positive during the active duty years, and negative during the retirement years.

The two crossover rates were found to be 5.2 percent and 17.6 percent, with investment in the scholarship program having a positive present value within this range and a negative present value at higher and lower discount rates. At a 10 percent discount rate, the present value of investment in the scholarship program is $15,520 per man. We

maintain that the relevant discount rate would almost certainly lie within this range, and the investment should be made in comparison with the civilian alternative.[22]

6. Comparisons Nos. 4 and 5

The fourth and fifth comparisons summarized in table 10 are again of a four-year scholarship and subsequent active duty career of 20 years with the civilian alternative. However, it is now assumed that the bonus legislation has replaced the current pay scale. We assume a bonus of $10,000 for each of the 12 unobligated years in case 4, and of $15,000 in case 5.

Under the $10,000 bonus assumption, the crossover rates are now 7.8 percent and 14.1 percent. The range of discount rates at which the investment is worthwhile is now narrower than when we used the current military pay scales, and the present value at 10 percent has decreased from $15,520 to $3627. There is still a positive return to the Navy during each of the active duty years beyond residency, but the size of the annual return is now much lower. This results in a narrowing of the range of discount rates within which the investment has positive present value. In our judgment, requiring a return on Navy investments of over 14 percent would appear unreasonable, but it is not clear that the choice of, say, 7-1/2 percent is unreasonable. At 7-1/2 percent, the investment would be rejected because of the heavy weight this rate places on the distant liability incurred for retirement pay.

Case 5 employs the assumption of a $15,000 bonus for all unobligated years. Now the return is negative during the last five years of active duty, and greatly reduced during the other 11 unobligated years. Table 10 shows that the present value is -$7228 at a 10 percent discount rate. We have ascertained that there is no discount rate between 0 and 50 percent which would result in a positive present value of this investment. We were unable to identify either crossover rate in 200 iterations; it is clear that these rates if they exist, do not lie within any range that would be considered relevant, and that in this particular case the investment would not be a prudent one for the Navy to undertake. Also, as tables 2 and 5 suggest, payment of this amount would result in a present value much higher than that of the alternative civilian stream, viewed either from the point of entry into medical school or the end of obligated service. It is likely that these amounts would be much higher than necessary for attraction and retention of scholarship recipients.

One cannot conclude, however, that the payment of a $15,000 bonus to a scholarship recipient for all unobligated years would never be a good investment. For example, if

[22] However, in comparison No. 10 we conclude that investment in a succession of scholarship recipients would be better than inducing one to stay for a 20-year career.

the physician's specialty were one with a median income substantially above the all-specialty median we used, the returns would be greater and extend over more years than in the comparison made. In this case, the investment may well have a high return.

7. Comparison No. 6

We were also curious about the sensitivity of the results under the $15,000 bonus assumption to the length of obligated service, which is the period of heaviest returns for the Navy. Therefore, we extended the obligation to five years, but still found negative present values at reasonable discount rates. However, as table 10 shows, extending the obligation to six years produced a present value of $1057 at 10 percent, and crossover rates of 9.2 percent and 13.4 percent. However, we would not recommend an investment which has positive present values only within such a narrow range of discount rates. Even if a 10 percent discount rate were thought appropriate, errors in estimating the outlay streams could easily make the investment appear worthwhile when it may not be.

8. Comparison No. 7

Next we compared the civilian alternative and the scholarship plan with a 4-year obligation, 20-year career, and a $15,000 bonus in all unobligated years, assuming a 2 percent real growth rate (i.e., constant dollars) in civilian income and in military base pay. (Therefore, the rate of growth is greater in civilian income than in total military pay.) We wanted to test the sensitivity of comparison number 5, which had negative present values at all discount rates between 0 and 50 percent, to these growth assumptions.

These assumptions resulted in a present value of investment in the scholarship program of $25,601 per man at a 10 percent discount rate, and crossover rates of 4 percent and 19.8 percent. The growth assumptions used clearly resuscitate the scholarship program as a worthwhile investment, even with payment of the maximum bonus. The problem is that one may easily arrive at the opposite conclusion using other equally reasonable assumptions about growth in military and civilian physicians' incomes.

The results will also be sensitive to the form of the increase in military pay, i.e., whether all of the increase is in base pay or whether it is in other components, such as special pay or allowances. Moreover, if the present pay scales were assumed, an increase in base pay would necessarily result in an increase in physicians' (and dentists') continuation pay, which is expressed as a multiple of base pay.[23]

9. Comparisons Nos. 8 and 9

The next two comparisons are between the procurement alternatives of a 4-year scholarship and obligation and 20-year career, and extending a direct commission to

[23] In our view, this brings out a serious shortcoming in linking continuation pay to base pay.

a fully-trained physician. In comparison No. 8, it is assumed that a $10,000 bonus is paid to both physicians during all unobligated years, and in comparison No. 9 both receive a $15,000 bonus in all unobligated years. This means that the physician receiving a direct commission is paid the bonus for the entire 20 years, while the scholarship recipient receives it for the last 12 years of active duty.

Under the $10,000 bonus assumption, investment in the scholarship plan has a present value of -$5208 at a 10 percent discount rate, and the crossover rates are 1.2 percent and 7.4 percent. We would not recommend the scholarship plan over the direct commission on the basis of these results. However, in our earlier analysis we expressed doubt that many fully-trained physicians could be attracted with this bonus. If they could be attracted and retained in specialties with incomes at or above the all-civilian median, this would appear preferable to investing in the scholarship program.

The $15,000 bonus would be more attractive to post-residents. Table 10 shows that investment in the scholarship program has a present value of $2186 at a 10 percent discount rate, and the crossover rates are 0 percent and 10.9 percent. However, tables 2 and 5 show that payment of a $15,000 bonus to scholarship recipients during all unobligated years results in an income of substantially higher value than the civilian alternative, and we doubt that it would be necessary either to attract or retain them. Therefore, it is clear that the scholarship program would be a good investment if it required a bonus of $15,000 to attract the fully-trained physician.

10. Comparison No. 10

Finally, we analyze whether it pays the Navy to retain most scholarship recipients for 20 years of active duty. The alternative is a succession of four scholarship recipients, each of whom leaves after completing the obligated service. In this comparison, all scholarship recipients are assumed to follow the pattern of a four-year scholarship, four years of military postgraduate training, and a four-year active duty obligation. The present military pay scale is used in our calculations.

The career physician enters medical school in year one, and serves as a post-resident during years 9 through 24, at which time he retires. Alternatively, the Navy could secure the services of one post-resident during these same 16 years by using a succession of scholarship recipients. The first would enter medical school in year one, and serve as a post-resident during years 9-12; the others enter medical school in years 5, 9, and 13. These patterns and the Navy's outlay streams are shown in table

A-17 (appendix A). The first pattern entails the financial disadvantages to the Navy of higher base pay, special pay, and continuation pay during the unobligated portion of the career (years 13-24) and the retirement pay liability; on the other hand, the second pattern entails the disadvantage of subsidizing the medical education of four physicians rather than one.

We first estimate the Navy's outlay for the career physician in each year. Next we estimate the outlays for noncareerists in each year. This stream of outlays is subtracted from the first to get the stream of differences, and the rate of return over cost is then calculated.

However, under both patterns the Navy's outlay during the internship and residency years is entered at zero, using the assumption about the value of these services discussed earlier.[24] This assumption is necessary here because during certain years under the second pattern, the Navy will be making outlays for one post-resident, one medical student and one resident, compared with one post-resident under the first pattern. If we include all three outlays under the second pattern, we will be comparing the cost of the services of one post-resident plus one resident with the cost of a post-resident alone. We want to compare the cost of obtaining the same services (namely, the services of one post-resident) during each year. Under the career pattern, this consists of the outlay for the post-resident during the years 9-16. Under the noncareer pattern, this consists of the outlay for the post-resident plus the outlay for the medical student, from whom no services are received during the year.

When we subtract the outlays under the second pattern from those under the first, the stream of differences consists of zero during the first four years, when the man is in medical school under either pattern. During the next 10 years, the differences are negative; that is, outlays under the second pattern are greater than under the first, because of the Navy's continuing investment in the medical education of several individuals. During the next two years, the differences are slightly positive because the career physician's higher base pay, special pay and continuation pay exceed the outlay on the medical student and noncareer post-resident combined. During the last eight years of active duty, the differences are more heavily positive because the last scholarship recipient has completed medical school under the second pattern. The differences are heavily positive during the retirement years, of course, because the retirement outlay is zero under the second pattern. (We assumed that the career physician lives until retirement; thereafter, the retirement pay liability stream was adjusted by survival probabilities.)

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[24] See pages 36 and 37.

The sequence of differences, therefore, is zero, negative, and positive. There is only one sign reversal; therefore, the rate of return on investment in a succession of scholarships will be unique.[25]

As table 10 shows, this rate of return is 10.4 percent. The present value of investment in four successive scholarships at various discount rates is as follows: 5 percent, $81,536; 6 percent, $53,129; 7 percent, $33,024; 8 percent, $19,134; 9 percent, $9160; 10 percent, $2084. If one maintains that the appropriate rate of return for Navy investment does not exceed 10.4 percent, the conclusion follows that it does not pay to attempt to retain scholarship recipients for 20 years, apart from that number which may be necessary to provide continuity in the administration of the medical department. It is clearly the retirement liability associated with the career pattern which renders the alternative an attractive investment.

Before concluding this section, the reader should be aware of certain assumptions and omissions which affect the above result. First, we have not estimated the additional accession and separation costs associated with the noncareer pattern. Second, we have assumed that all post-residents are equally productive, regardless of length of experience. These two factors bias the results against the career alternative. Third, we have not allowed for growth in the active duty pay scale over time, although we did adjust the pension upward. This biases the result against the noncareer alternative, because equal percentage increases in base pay would result in a greater difference between the pay of higher and lower ranks, and would also result in a greater increase in continuation pay for the careerist. Fourth, we used the present pay scale. Under the assumption of either a $10,000 or $15,000 bonus during unobligated years, the noncareer alternative would show a much higher rate of return because a bonus would only be paid to careerists. In our judgment, the net result of the above factors is an understatement of the return on investment in the noncareer alternative.

The conclusion follows that it does not pay the Navy to retain most physicians for 20 years. It will, of course, be necessary to retain a number of career physicians to provide continuity in the administration of the medical department. It is also possible that the number of scholarships would result in annual accessions which are insufficient to meet the authorized staffing level. This could be calculated for various staffing levels. In this case, it may be necessary to retain physicians over and above the number needed to provide continuity in order to fill all billets. However, it would still be preferable to seek an increase in the number of scholarships authorized.

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[25] In accordance with our previous discussion, the succession of scholarship recipients may clearly be classified as an investment compared with the single scholarship and 20-year career.

B. Retention Objectives and the Bonus Legislation

The comparison of the preceding section shows that it does not generally pay to retain a physician for 20 years; that is, investment in a succession of scholarship recipients to provide services over the same length of time yields a high return for the Navy. Moreover, this comparison was made under the assumption of present military compensation; the investment would yield an even higher return if it were necessary to pay the careerist a bonus in excess of present continuation pay in order to retain him. Our analysis also indicated that the scholarship program is expected to be successful in attracting physicians.

In view of this, one may question whether passage of the bonus legislation is economically advisable. We believe that it is, for three reasons:

(1) It will provide DoD with a flexible tool to adapt quickly to changing market conditions in the all-volunteer environment.

(2) It will facilitate the transition to an all-volunteer force while the Berry Plan is being phased out and the scholarship program begins to produce trained physicians.

(3) In the analyses presented in this study, we have necessarily had to rely on imperfect data and to make numerous assumptions, and our conclusions are potentially very sensitive to the assumptions and data employed.[26] Yet we are reasonably confident that the combination of the scholarship program and the bonus legislation will enable the Navy to attract and retain enough physicians to fill whatever number of positions is likely to be authorized, whether 4000, 3500, or 3000. Moreover, we believe that these two economic tools will enable the Navy to achieve a satisfactory experience distribution among its physicians after the transition period. It appears unlikely that this will be possible with the scholarship legislation and current military compensation.

We have acknowledged that it would be desirable to retain a number of career physicians, but unfortunately no one seems to know what constitutes the best experience distribution. It is commonly said that retention of military physicians is too low and that the proportion of careerists in the total is also too low. These statements are not identical. Table 11 shows the distribution of Navy physicians as of 30 June 1973 by years of active military service.

[26] Indeed, it is for these reasons that we present our data and assumptions in such great detail in appendix A, viz., so that other analysts may substitute different assumptions or better data or analyze different alternatives.

TABLE 11

DISTRIBUTION OF NAVY PHYSICIANS BY LENGTH OF ACTIVE DUTY MILITARY SERVICE AS OF 30 JUNE 1973

Years of service	Number
1	1738
2	574
3	313
4	193
5	155
6	127
7	156
8	36
9	57
10	60
11	22
12	39
13	51
14	66
15	62
16	89
17	64
18	53
19	48
20	39
21	21
22	16
23	14
24	9
25	6
26	13
27	14
28	14
29	9
30	20
Total	4079

Source: Bureau of Medicine and Surgery

The table shows that of the 4079 total physicians, 57 percent had less than two years of service and 64 percent had less than three years. The turnover associated with this distribution is in the range of 25 to 30 percent per year. If a high proportion of inexperienced physicians and a concomitant high turnover rate are what is meant when it is said that retention is too low, then this seems indisputable by virtually any standards. Of course, this phenomenon is a result of the draft, and it will change gradually [illegible]cholarship recipients become the main source of accessions. The time between entry into the scholarship program and completion of residency is about 8 years, but increasing the experience distribution could be hastened by increasing retention through use of the bonus.

Table 11 also shows that 69 percent of all physicians have less than 5 years of service, 13 percent have 5 to 10 years of service, and 18 percent (or 729) have over 10 years of service. There are several possible reasons for wanting to alter this distribution, apart from the high costs of rapid turnover among younger physicians. No doubt it would be desirable to increase the proportion in the second group and decrease the proportion in the first group, but it is not at all clear what proportion should be induced to remain for a career of 20 years or longer. A physician's productivity may increase with experience, but to the extent that this is reflected in civilian earnings profiles, most of this occurs in the first several years after completion of residency. Thereafter, the earnings profiles are remarkably flat. Increasing productivity would appear to provide a reason for increasing the proportion of experienced physicians, but not necessarily for inducing them to remain for 20 years.

However, there are individual physicians whose ability far exceeds the average; many of these would be utilized in teaching hospitals, and some would eventually become chiefs of service and directors of internship and residency programs. These individuals also have above-average earnings capabilities in the civilian sector, and it would be worth the use of the bonus to retain them. It is also desirable to retain physicians for 20 or more years to provide continuity in the administration of the medical department in peacetime and to be able to direct the deployment of medical resources in wartime. Whether the present proportion of physicians with over 10 years of service is sufficient for these purposes, we are unable to say. It is clear that the combination of the scholarship program and the bonus legislation would enable the Navy to increase the experience distribution of its physicians, but the extent to which this should be done (the "optimal" experience distribution) is not at all clear, and probably never will be. The heavy retirement costs should be taken into account in the formulation of goals with respect to retention of physicians until retirement.

We have little doubt that the most efficient pay system for physicians would be to eliminate the grade structure and establish a separate pay scale for military physicians,

as suggested by the Medical and Dental Officer Billet Requirements Study Group.[27] However, our purpose here is much more limited, namely, to assess the effects of the bonus as it has been proposed by DoD. It provides a much more flexible tool than continuation pay, which it would replace. Its success would depend upon the way in which it is administered, as DoD recognizes. The amount of the bonus could vary by specialty, and it need not be offered to all individuals within a specialty.[28] The program would be reviewed annually and adjustments made as needed, based upon staffing experience.

Of course, the same advantages were claimed for continuation pay, but all specialties were declared eligible and very few physicians are denied continuation pay for cause.[29] This was because in every specialty military pay was so far below civilian pay. It will still be necessary to pay some bonus to most unobligated physicians the Navy wishes to retain, but our analysis indicates that it will not be necessary to pay the maximum amount to all of them. The bonus legislation has three important advantages over continuation pay as a personnel management tool.

(1) The criteria for eligibility are much simpler; it can be paid to any unobligated physician at any time, including initial entry. Although the conditions for eligibility for continuation pay have been continuously liberalized, they are still less flexible than the bonus.

(2) The amount of the bonus can be varied by specialty. Continuation pay can be offered to a specialty or not, but if it is offered, it is paid at the same rates (established by law) for each specialty.

(3) Perhaps the most important advantage of the bonus is that it is not tied to base pay, as is the case with continuation pay. Continuation pay, as noted, is expressed as a multiple of base pay. This feature is undesirable in principle. Each time there is an increase in the general level of military base pay, continuation pay automatically increases, regardless of recruiting and retention experience in the specialty. This multiple is 4 times the monthly base pay for the pay grades 0-4 through 0-6. Although there may be no problem in retaining 0-6s in a given specialty, every time base pay rises, so does their continuation pay. Under the bonus legislation, a conscious policy decision will have to be made in order for an increase (or decrease) to occur. This will provide

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[27] This would replace the complex set of measures which the military has used in an attempt to narrow the differentials between civilian and military earnings, such as rapid promotion, higher entry grades, constructive longevity for pay purposes, special pay and continuation pay.

[28] All physicians now receiving continuation pay would probably receive at least the same amount as a bonus in order to prevent pay decreases.

[29] For a history of continuation pay and its administration, see Chapter II, Report of the 1971 Quadrennial Review of Military Compensation, op. cit.

an incentive for periodic review of recruitment and retention experience in each specialty. The bonus legislation will also enable DoD to restructure the income-experience profile so that it can more closely resemble the profile in the civilian sector, with which DoD must now compete.

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APPENDIX A

CONSTRUCTION OF THE MODEL: ASSUMPTIONS, DATA AND METHOD

This appendix contains detailed information about the construction of our model: the assumptions employed, the sources of data, and the way in which estimates were derived and calculations made. The purpose is to enable the reader to replicate our results or to use our work as a basis for constructing an improved model. As we noted in the text, numerous decisions had to be made about the data used in estimating components of income and about the assumptions employed. It is unlikely that any reader will agree with all of our decisions. The information presented here should enable him to substitute better data as they become available and to substitute different assumptions. It can also serve as a basis for constructing "dynamic models," that is, models in which growth in the income streams is projected.

There are three basic career patterns (with numerous variants) which we have investigated: (1) an all-civilian career; (2) a 20-year Navy and subsequent civilian career; and (3) a career including only an initial period of Navy service. Certain assumptions were common to all the career patterns analyzed. We assumed that physicians entered medical school at age 22, completed four years of medical school, a one-year internship, a three-year residency, and retired completely at age 65.[1]

There are four sections to this appendix. The first discusses the components of the Navy physician's income stream; the second discusses the components of the civilian physician's income stream; the third discusses the components used in calculating return on the Navy's investment; and the fourth presents the data used in our calculations.

I. COMPONENTS OF THE NAVY PHYSICIAN'S INCOME

(A) Scholarship Stipend

The student accepting a DoD scholarship receives a stipend of $400 per month for 10-1/2 months and the pay and allowances of pay grade 0-1 for 45 days during each year of medical school. We estimated income as $5308 for the first two of these years and $5340 for the second two. Basic allowance for quarters during the 45 days was estimated

[1] It has been pointed out to us that the American Medical Association has recommended the integration of internships with residencies, and that some specialty boards have changed their requirements in such a way as to shorten the total time required for postgraduate education. However, as of this writing, four years of postgraduate training still appears to be the most common requirement for certification. Military postgraduate training programs follow the requirements of the AMA and the specialty boards. (Directory of Approved Internships and Residencies; 1972-1973, Chicago: American Medical Association, 1972, pp. 33-38B and 379-438.)

by using an average of the rates for an 0-1 with and without dependents.[2] The entire amount was treated as subject to income and social security taxes, although a small component (quarters and subsistence allowance for 45 days) is nontaxable. The Internal Revenue Service has ruled that the stipend is taxable income. While in medical school, the student is a member of the inactive reserve, and is not entitled to medical care and other nonmonetary benefits.

The Navy pays for the scholarship student's tuition, fees, books, and laboratory expenses during medical school. These were not entered into his income stream, although they were included in the Navy's expenditures. The reason for this exclusion is that the principal alternative we compared with the DoD scholarship was attending medical school at one's own expense, and we have entered these expenses as negative items for this alternative. The opportunity cost of choosing one alternative is foregoing the other; in this case, the student who does not accept the scholarship foregoes the stipend and also must pay his own tuition. To include tuition both as a positive item in the scholarship recipient's income stream and a negative item in the civilian student's income stream would result in double counting and overstating the difference between the two streams during these years.

We did not evaluate the financial attractiveness of a medical career under the scholarship program compared with non-medical careers, even though we have said that we expect the scholarship program to prove attractive to students who might otherwise have been deterred from choosing a medical career. It is clear that investment in a medical education has a high rate of return compared with most nonmedical alternatives, even if the student bears the entire cost of his own medical education.[3]

(B) Base Pay

Base pay of the Navy physician on active duty was estimated using the entry grades, promotion profile, and years of service creditable for pay purposes set forth in DoD Directive 1320.7.[4] These profiles are shown in table A-1 for both the scholarship recipient and the post-resident accepting a direct commission. The pay scale in effect on

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[2] In table A-12, the four components of income during these years (stipend, base pay, quarters allowance and subsistence allowance) are combined under base pay.

[3] See, for example, the rates of return to medical education calculated by Rashi Fein and Gerald I. Weber, Financing Medical Education, New York: McGraw-Hill Book Co., 1971, Appendix C. This conclusion is supported by the ratio of medical school applicants to enrollees, which has been increasing over the past several years and is currently estimated at 2.6 to 1. (1973-1974 Medical School Admission Requirements, 23rd edition, Washingington, D.C.: Association of American Medical Colleges, 1972, p. 16.)

[4] Department of Defense Directive Number 1320.7, ASD (H&E), August 7, 1970, Subject: Temporary Grades and Authorized Strengths in Grade of Medical and Dental Corps Officers.

January 1, 1973 was applied to these profiles. The post-resident enters active duty with eight years of service creditable for pay purposes, based on four years of medical school and four years of postgraduate training; the scholarship recipient receives credit for four years of medical school. Only active duty is creditable for retirement purposes.

TABLE A-1

PROMOTION AND PAY PROFILES OF SCHOLARSHIP RECIPIENT AND POST-RESIDENT

	Scholarship recipient			Post-resident		
Years of active duty	Age	Rank	Years for pay purposes	Age	Rank	Years for pay purposes
1	26	Lt. (0-3)	4	30	LCdr. (0-4)	8
2	27	"	4	31	"	8
3	28	"	6	32	"	10
4	29	LCdr. (0-4)	6	33	"	10
5	30	"	8	34	"	12
6	31	"	8	35	Cdr. (0-5)	12
7	32	"	10	36	"	14
8	33	"	10	37	"	14
9	34	Cdr. (0-5)	12	38	"	16
10	35	"	12	39	"	16
11	36	"	14	40	"	18
12	37	"	14	41	"	18
13	38	"	16	42	Capt. (0-6)	20
14	39	"	16	43	"	20
15	40	"	18	44	"	22
16	41	Capt. (0-6)	18	45	"	22
17	42	"	20	46	"	22
18	43	"	20	47	"	22
19	44	"	22	48	"	26
20	45	"	22	49	"	26

Source: DoD Directive 1320.7

(C) Special Pay

All Navy physicians except interns receive special pay. The current special pay is:

Years of active duty	Annual special pay
Under 2	$1200
Under 6	1800
Under 10	3000
Over 10	4200

Under the "Uniformed Services Special Pay Act of 1973," sponsored by the Department of Defense, special pay would be $1200 per year for physicians with less than two years of active duty, and $4200 per year thereafter. Under either version of special pay, the scholarship recipient would not receive it during his first year of active duty while he is an intern.

(D) Continuation Pay

Under the present military compensation, continuation pay may be offered to physicians who:[5]

(a) are serving on active duty in a critical specialty;

(b) have completed the initial active duty obligation;

(c) agree to remain on active duty for at least an additional year;

(d) have completed five years of service (time spent in civilian residency is credited);

(e) are serving in pay grade 0-4 and above; and

(f) are determined to be fully qualified in their critical specialty.

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[5] Department of Defense Directive Number 1340.8, ASD (H&E), June 23, 1970, Subject: Continuation Pay for Medical and Dental Corps Officers.

Annual continuation pay is calculated as a multiple of base pay as follows:

Pay grade	Amount
0-9	1 month
0-8	2 months
0-7	3 months
0-4, 0-5, 0-6	4 months

The Assistant Secretary of Defense (Health and Environment) designates the critical specialties, and under current regulations all physicians otherwise qualified are eligible.

Continuation pay is usually paid as a lump sum at the beginning of the year.[6] The physician who received a 4-year scholarship becomes eligible for continuation pay in the 13th year after entering the program, which is his 9th year on active duty. The unobligated post-resident accepting a direct commission would receive continuation pay in his third year of active duty. His three years of residency training are counted toward fulfilling the 5-year active duty requirement for purposes of eligibility to receive continuation pay.

(E) Variable Incentive Pay (Bonus)

Under the proposed "Uniformed Services Special Pay Act of 1973," the Secretary of Defense may pay a bonus not to exceed $15,000 per year to physicians in critical specialties who agree to remain on active duty for a specified number of years. This bonus, or variable incentive pay, would replace the present continuation pay. Only those who have completed any prior obligated service would be eligible.

The Secretary of Defense would have considerable flexibility in the administration of this bonus. At present, the Defense Department is contemplating offering service agreements of 3, 5, and 6 years if the bonus bill is enacted. However, DoD may terminate the bonus at any time, in which case the physician is entitled to the bonus only for the fractional part of the active duty period actually served. There is also flexibility with respect to the timing of the bonus payment, which may be annually, semiannually, monthly, or in a lump sum at the end of the year. The intent of DoD is to pay the bonus in a lump sum at the end of the year. Bonuses of varying sizes, ranging from zero to $15,000 could be paid according to specialty.

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[6] See the section on discounting below for treatment of this item in calculating present values.

The elimination of continuation pay means that Navy physicians now serving beyond their obligation would receive a substantial reduction in pay unless all physicians received some bonus. Therefore, the present intent is to establish two levels of bonus, the maximum and a lesser amount. In our calculations, we have assumed two levels of bonus, $10,000 and $15,000 annually, to be received during all years of unobligated service.

We have assumed that the physician views receipt of the bonus as certain, even though the Secretary may terminate it entirely at any time or may change the designated specialties. The alternative would be to attach probabilities to the receipt of the bonus in any given year (and these would vary by specialty), and we have no basis for doing so. As noted, it is likely that all physicians would receive a bonus at least of the approximate size of present continuation pay. Moreover, we consider it unlikely that the Secretary will, in fact, terminate a bonus during the life of an agreement, although he has the authority to do so.

The scholarship recipient would become eligible for the bonus during the same year in which he now becomes eligible for continuation pay, that is, his ninth year of active duty and thirteenth year after entering the program. The unobligated post-resident accepting a direct commission would be eligible for the bonus immediately, whereas he must serve two years before becoming eligible for continuation pay. We have assumed that he will receive the bonus during his entire 20-year career.

(F) Military Retirement Pay

Under the present military nondisability retirement system, the service member may retire after 20 years of active duty with a pension equal to 50 percent of the base pay of the highest grade in which he served satisfactorily. Each subsequent year of service increases the pension by 2-1/2 percentage points up to a maximum of 75 percent of base pay with 30 years of service. He receives nothing if he retires earlier, except for disability or "selection out."[7]

The scholarship recipient would retire after 20 years with a final base pay of $22,824 and a pension of $11,412; the post-resident's final base pay would be $24,750 and his retirement pay would be $12,375. However, as we discussed in Section III, use of these amounts will understate the difference between the Navy physician's income after Navy retirement and that of the civilian physician. Our use of the static model (using cross-sectional data rather than projecting secular growth in income streams) is based on the

[7] Promotion rates in the medical corps are very high, and "selection out" is an infrequent occurrence. All calculations in the text of this report are based upon retirement under the present system after 20 years of active duty. We did not take account of retirement or separation because of disability. A comparison of the present nondisability retirement system with the new system proposed by DoD is the subject of appendix B.

assumption that the absolute changes in the income streams which do occur will be the same for the Navy and civilian physician. Therefore, the differences between the streams will remain the same. However, to the extent that any increase in Navy income takes the form of an increase in basic pay, military retirement pay will increase. We have assumed that the Navy physician receives the same income from practice during his post-retirement career as his civilian counterpart, therefore, his retirement pay will necessarily increase differentially.

Three ways of circumventing this difficulty occurred to us, none of them completely satisfactory. The first is to project growth in the military and civilian income streams (i.e., use a dynamic model), a procedure which in our view presents several more serious difficulties. The second is to assume that any increase in Navy pay during the active duty years is in components other than base pay, such as continuation pay, special pay, variable incentive pay, or allowances, none of which enter into the calculation of retirement pay. This is clearly an untenable assumption. Section 8 of Public Law 90-207 (the "Rivers Amendment") provides that each time the general schedule for federal civil service employees is increased, a comparable increase is to be applied to military pay, the entire adjustment being made in base pay. Thus, when civil service employees received a 5.14 percent increase in January 1973, military base pay was increased by 6.69 percent. Civil service increases, in turn, are linked to increases in the private sector. The change in the Rivers Amendment proposed by the Administration[8] would retain the link between military and civilian pay, however, it would give the President discretion to distribute the military pay increase among base pay, the quarters allowance, and the subsistence allowance. One purpose of the proposal is to reduce future retirement costs. However, some of the increase would undoubtedly be in base pay.

The third way of dealing with the problem is to adjust military retirement pay only, and this is the method we have chosen. We have assumed a 2 percent annual real (constant dollars) growth rate in base pay and hence in retirement pay. For the scholarship recipient, the final year of active duty is 24 years in the future, therefore, we have compounded the $11,412 retirement pay at 2 percent annually for 24 years, resulting in an adjusted retirement pay of $18,355. The post-resident's retirement pay of $12,375 is compounded at 2 percent annually for 20 years, resulting in an adjusted retirement pay of $18,389. Military retirement pay is taxable. The 2 percent real growth assumption was based on an examination of changes in the base pay of an 0-3 (over 6 years), an 0-4 (over 10 years), and an 0-6 (over 22 years) in 1952, 1963 and 1973. These were adjusted using the Comsumer Price Index. We found that the real growth rate in base pay averaged about 2-1/4 percent annually over the period 1952-1973 and 1-1/2 percent over the period 1963-1973. These were similar to real increases in civilian earnings, as measured by adjusted

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[8] A bill to amend title 37, U.S. Code, attached to a letter to the Speaker of the House of Representatives from the Assistant Secretary of Defense (Health and Environment), 30 March 1973.

hourly earnings in private nonagricultural employment. The real increases in the latter averaged 2.22 percent annually over the period 1953-1972 and 1.78 percent for the period 1963-1972.[9]

During the retirement years, military retirement pay is adjusted according to changes in the Consumer Price Index; however, since our income streams are in constant dollars, it was not necessary to make an adjustment for these price changes.

(G) Second-Career Income and Retirement Contributions and Benefits

We have assumed that the physician who leaves the Navy, either at the end of obligated service or after a 20-year career, pursues a civilian career until age 65, and that he is able to obtain the same median income as his civilian counterpart with the same length of experience. This assumes that the period of practice build-up is negligible. We were unable to find any empirical evidence concerning the incomes received by physicians after leaving the Navy. Our assumption is based on anecdotal evidence provided by members of the defense community concerned with physician retention. The civilian income figures we used (discussed in the following section) apparently contradict this in that they show markedly lower incomes during the first two years of practice than during the third and subsequent years. This would suggest a two-year build-up period. However, these low incomes are experienced by young physicians who have just completed residency. There may be ways in which experienced physicians leaving the Navy can avoid most of these costs. If former Navy physicians do, in fact, experience substantially lower incomes than their civilian counterparts initially, our analysis will make it appear as though remaining in the Navy is less attractive than is the case.

We have also assumed that the physician who leaves the Navy makes tax-sheltered contributions toward complete retirement at age 65 under the "Keogh Plan," in the same way as his civilian counterpart.[10] The benefits he receives from this plan upon retirement will, of course, be less than the civilian's because contributions will have been made over a shorter time period. However, his total income during the years of full retirement will approximate that of the civilian because of his military retirement pay.

(H) Federal Income Tax

The compensation elements discussed in the preceding sections are all subject to federal income tax, and these were added to get the income subject to taxation or "adjusted gross income" as that term is defined in the Internal Revenue Code. The one exception is

[9] Economic Report of the President, January 1973, Washington, D.C.: U.S. Government Printing Office, 1973, p. 228.

[10] Contributions and benefits under the Keogh Plan are discussed in the following section.

the tax-sheltered Keogh Plan contributions, which were deducted from the other items in arriving at adjusted gross income. The federal income tax was then estimated and deducted from the adjusted gross. The tax estimate used for the relatively low income of the scholarship recipient during the four medical school years was based on the actual (average) tax rate of 6.3 percent for all taxpayers in the $5,000-$6,000 income bracket shown in Pechman.[11] This procedure was not used throughout, because for higher incomes the ranges used by Pechman are wide, and application of the average tax rates shown in his table result in implied marginal tax rates in excess of 100 percent in some cases. The maximum marginal tax rate on labor income, including income from professional practice, is 50 percent.

During the other years we constructed our own estimates by converting adjusted gross income to taxable income, using Internal Revenue Service data for 1969 based upon 34 million joint tax returns with itemized deductions.[12] For each income range shown, we divided total taxable income by total adjusted gross income to derive factors for converting adjusted gross incomes to taxable incomes. (The difference between the two consists of deductions and exemptions.) We then applied these conversion factors to the mid-point of narrower income brackets of $1000 to get taxable income. Finally, we examined the tax tables and applied the amount of tax closest to the taxable income. (Greater precision is possible, but not warranted.) Table A-2 summarizes these calculations and also shows the marginal tax rate applicable to the various income brackets. This table enables the reader to quickly estimate the average income tax actually paid on the adjusted gross incomes shown.

(f) Social Security Taxes

Social security taxes were estimated and deducted from income net of federal tax, based upon the schedule of rates and taxable earnings set forth in the 1972 Social Security amendments. The tax rates for employees were applied to the Navy physician's base pay, and those for self-employed persons to his income during years of private practice. The first year in our income streams was assumed to be 1973. All physicians will pay the maximum amount of social security taxes, except for the scholarship recipient during the first six years of his career. Table A-3 shows the schedule of rates and the maximum amount of social security tax in any given year.

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[11] Joseph A. Pechman, Federal Tax Policy, revised edition, Washington, D.C.: The Brookings Institution, 1971, p. 298.

[12] Internal Revenue Service, Statistics of Income - 1969: Individual Income Tax Returns, Washington, D.C.: U.S. Government Printing Office, 1971, pp. 85 ff. Subsequently, data based on a sample of 1971 returns became available. Available data pertained to all returns, joint and single, and itemized and standard deductions. Nevertheless, the conversion factors derived from this source closely approximated those we used. (Internal Revenue Service, Preliminary Statistics of Income - 1971: Individual Income Tax Returns, Washington, D.C.: U.S. Government Printing Office, 1973, p. 9.)

TABLE A-2

ESTIMATES OF FEDERAL INCOME TAXES PAID BY ADJUSTED GROSS INCOME

Adjusted Gross Income	Conversion Factor	Taxable Income	Tax	Marginal Tax Rate
$11,000 under $12,000	63%	7245	1237	19%
12,000 - 13,000		7875	1352	
13,000 - 14,000		8505	1490	22%
14,000 - 15,000		9135	1633	
15,000 - 16,000	70%	10850	2007	
16,000 - 17,000		11550	2161	
17,000 - 18,000		12250	2323	25%
18,000 - 19,000		12950	2498	
19,000 - 20,000		13650	2673	
20,000 - 21,000	73%	14965	2998	
21,000 - 22,000		15695	3185	
22,000 - 23,000		16425	3372	28%
23,000 - 24,000		17155	3582	
24,000 - 25,000		17885	3792	
25,000 - 26,000	75%	19125	4128	
26,000 - 27,000		19875	4338	
27,000 - 28,000		20625	4572	32%
28,000 - 29,000		21375	4812	
[illegible]00 - 30,000		22125	5052	
[illegible]000 - 31,000	78%	23790	5596	
31,000 - 32,000		24570	5858	36%
32,000 - 33,000		25350	6146	
33,000 - 34,000		26130	6434	
34,000 - 35,000		26910	6704	
35,000 - 36,000		27690	6992	
36,000 - 37,000		28470	7295	39%
37,000 - 38,000		29250	7568	
38,000 - 39,000		30030	7880	
39,000 - 40,000		30810	8270	
40,000 - 41,000		31590	8660	42%
41,000 - 42,000		32370	8870	
42,000 - 43,000		33150	9080	
43,000 - 44,000		33930	9500	
44,000 - 45,000		34710	9920	
45,000 - 46,000		35490	10130	
46,000 - 47,000		36270	10565	45%
47,000 - 48,000		37050	10790	
48,000 - 49,000		37830	11240	
49,000 - 50,000		38610	11465	
50,000 - 100,000	80%	-	-	46 - 50%

Source: See text.

TABLE A-3

SOCIAL SECURITY TAXES

Year	Employees' Tax rate[a]	Maximum amount of tax
1973	5.85%	$631.80
1974-1977	5.85%	702.00
1978-1980	6.05%	726.00
1981-1985	6.15%	738.00
1986-2010	6.25%	750.00
2010 and after	7.3%	876.00
	Self-employed	
1973	8.0%	$864.00
1974-1977	8.0%	960.00
1978-1980	8.25%	960.00
1981-1985	8.35%	1002.00
1986 and after	8.45%	1014.00

[a]Total OASDI and hospital tax rates.

(J) State Income Taxes

We were unable to include estimates of state income taxes because of the great diversity in state income taxes. Some states have no income tax. State income taxes are not withheld from military pay, and the military physician would appear to have greater flexibility than the civilian in choosing a state of residence for tax purposes.

(K) Nontaxable Cash Income: BAQ, BAS, and Social Security Benefits

These nontaxable cash elements of compensation are added to after-tax incomes to calculate net cash pay. The use of after-tax incomes automatically values nontaxable elements correctly. That is, we can compare the after-tax incomes of military and civilian physicians directly; it is not necessary to estimate the taxable equivalent of these components as is the case when pre-tax incomes are compared.

The basic allowances for quarters (BAQ) and subsistence (BAS) used are those in effect on January 1, 1973. The subsistence allowance for officers is $575 per year without regard to rank or number of dependents, as it has been since 1952. We assumed that military physicians are married at the time of entry on active duty and remain married thereafter. Therefore, the quarters allowances used are those for officers with dependents. These amounts vary with pay grade, as follows:

Pay grade	Annual basic Allowance for quarters
0-6	$3100
0-5	2866
0-4	2585
0-3	2374
0-2	2110
0-1	1699

Social Security benefits were based on the Social Security amendments of 1972. Upon attaining age 65, the physician receives the maximum primary benefit of about $4860 per year. We have assumed that he has a wife four years younger than he is, therefore, four years later he receives a family benefit of $7284.

(L) Non-cash Elements of Compensation: Medical Care, Disability, Commissary Privileges

Accurate estimation of the value the military physician places upon non-cash elements of compensation is not possible. However, we have made estimates of three of these elements, viz., medical care, disability insurance, and commissary privileges. Other items were not included either because their value is small or the difficulties of estimation were too great. The combined value of the three benefits for which we did prepare estimates totals about $1000 during most active duty years. We have undoubtedly underestimated the value of non-cash benefits, and perhaps substantially; the most that can be said is that the underestimation would be greater if we ignored all such benefits.

Our estimates of the value of medical care were based upon premiums paid by self-employed physicians for health insurance. About 95 percent of these physicians carry family medical-surgical insurance, family hospitalization insurance, or both. The median premiums paid by different age groups in 1971 are shown in table A-4.

TABLE A-4

HEALTH INSURANCE PREMIUMS PAID BY SELF-EMPLOYED PHYSICIANS, 1971

Age group	Annual premium (median)
30-39	$416
40-49	446
50-59	499
60-69	445

Source: Medical Economics, December 18, 1972, p. 79.

These amounts were added to the income streams of Navy physicians in the same age groups. No entry was made for the scholarship recipient during the medical school years because he is ineligible for military medical care during most of this time. We also did not include this item during the years of internship and residency because we have no information about the premiums paid by civilian interns and residents, if any. Medical care may be available to them through the hospital with which they are affiliated, and if so, free medical care is not a differential benefit enjoyed by the military physician during these years. The value of this benefit was included throughout the entire lifetime of the Navy physician who retires after 20 years of service. The retired Navy physician and his dependents are eligible for care in military facilities for life. It is true that after retirement he may not be located near a military facility or choose to use military medical care. However, the retired physician and his family are also insured for care in civilian facilities under CHAMPUS until age 65.

Approximately 85 percent of self-employed physicians also carry disability insurance. The median premium paid and monthly benefit entitlement by age groups are shown in table A-5.

TABLE A-5

DISABILITY INSURANCE PREMIUMS PAID BY SELF-EMPLOYED PHYSICIANS AND BENEFIT ENTITLEMENTS, 1971

Age Group	Median annual premium	Median monthly benefit
30-39	$408	$1625
40-49	557	1509
50-59	540	1289
60-69	472	968

Source: Medical Economics, December 18, 1972, p. 80.

The military physician is eligible for disability retirement if he becomes disabled while on active duty, and he pays no explicit premium for this benefit. There are several provisions in the law under which he may retire, depending upon such factors as the circumstances and degree of disability and his length of service. We have assumed that if he becomes disabled during active duty, he will retire under Section 1201, Title 10, of the U.S. Code, with a disability rating of 50 percent. We estimated the average monthly base pay for the scholarship recipient and the post-resident during the years when they would be in the age groups 30-39 and 40-49. The monthly disability benefit would be 50 percent of base pay, substantially lower than the monthly benefits purchased by civilian physicians, as shown in table A-5. Therefore, we divided the monthly benefit by the civilian monthly benefit; we then multiplied the annual disability premium paid by civilian physicians by this percentage to estimate the value of military disability insurance. This procedure assumes that premiums are directly proportionate to benefits. These calculations are summarized in table A-6. For the scholarship recipient, we assigned an arbitrary value of $50 per year to disability insurance during the internship and residency years. These estimates were added to the military income streams during the active duty years.

Our procedure for valuing the medical care and disability insurance provided without cost to the military physician was to use the amounts paid by his civilian counterpart to purchase similar benefits. It was not possible to use this procedure to evaluate commissary privileges, for which there is no comparable benefit in the civilian sector. The value of this benefit was based on the estimated savings on commissary purchases by military families according to after-tax incomes and family size presented in the Hubbell Report.[13] The procedure used there was as follows: (1) items sold in the commissary were identified; (2) amounts spent on these items by civilians with various after-tax incomes and family sizes were obtained from a 1960-61 survey of consumer expenditures by the Bureau of Labor Statistics; (3) military personnel with the same incomes and family sizes were assumed to purchase the same quantities of these goods through the commissary; (4) percentage discounts available through the commissary were applied and the savings estimated. (There are some methodological deficiencies in this procedure which need not detain us here.)

The method by which we adjusted the data in the Hubbell Report is best explained with reference to table A-7. Column 1 shows the 1961 after-tax incomes used in the Hubbell Report; however, these incomes had greater purchasing power in 1961 than in 1973 (or than in 1967, when the Hubbell Report was prepared). Therefore, the incomes were adjusted upward by multiplying them by the ratio of the December 1972 Consumer Price Index to the 1961 Index (127/90 = 1.4), as shown in column 2. Columns 3 and 4 show the years in the income profiles of the scholarship recipient and post-resident, respectively, during which their after-tax incomes correspond to those shown in column 2.

[13] Modernizing Military Pay: Report of the First Quadrennial Review of Military Compensation, Volume I, Active Duty Compensation, Department of Defense, Washington, D.C.: U.S. Government Printing Office, 1 November 1967, Table 6-2, p. 108.

TABLE A-6

ESTIMATION OF VALUE OF MILITARY DISABILITY RETIREMENT BENEFIT

(1) Military profile	(2) Years in income stream	(3) Age	(4) Monthly military disability benefit[a]	(5) Monthly civilian disability benefit	(6) Military benefit as percent of civilian (column 4 ÷ column 5)	(7) Civilian disability insurance premium	(8) Estimated value of military disability insurance (column 7 x column 6)
Scholarship	9-18	30-39	$648	$1625	40%	$408	$163
Scholarship	19-24	40-45	895	1509	60	557	222
Post-resident	1-10	30-39	646	1625	40	408	163
Post-resident	11-20	40-49	924	1509	60	557	222

[a]50 percent of average monthly military base pay during these years.

TABLE A-7

ADJUSTMENT OF HUBBELL REPORT ESTIMATES OF VALUE OF COMMISSARY SAVINGS

(1) After-tax[a] income 1962 dollars	(2) Equivalent in Dec 1972 dollars (column 1 x 1.4)	(3) Years[b] in scholarship profile	(4) Years[b] in post-resident profile	(5) Annual[a] savings, scholarship recipient	(6) Adjusted savings scholarship recipient (column 5 x 1.4)	(7) Annual[a] savings, post-resident	(8) Adjusted savings, post-resident (column 7 x 1.4)
$7,975 to 10,630	$11,165 to 14,882	5-6		$165	$231		
$10,630 to 15,945	$14,882 to 22,323	7-12	1-4	$186 (Years 7-10)	$260	$186 (Year 1)	$260
				$235 (Years 11-12)	$329	$235 (Years 2-4)	$329
Over $15,945	Over $22,323	13-24	5-20	$259 (Year 13)	$363	$315 (Years 5-20)	$441
				$315 (Years 14-24)	$441		

[a]From Hubbell Report.
[b]"Years" refers to years in the income profile of the military physician.

Commissary expenditures, and hence savings, are a function of family size as well as income. We assumed that military physicians are married throughout the active-duty years and have children at ages 31 and 34. These ages correspond to the 11th and 14th years in the income profile of the scholarship recipient and the 2nd and 5th years in the profile of the post-resident. We then took the savings estimated in the Hubbell Report by income group and family size and matched our two military profiles with them (columns 5 and 7). These savings were then adjusted upward by the ratio of the food component of the December 1972 Consumer Price Index to that of the 1961 index (126/89 = 1.4) to estimate the value of commissary savings today.

We entered these estimates only during the active duty years, even though commissary privileges are extended to retired military personnel. However, utilization of this privilege after retirement depends upon proximity to a military commissary, and we consider that families with the income levels indicated in this report are unlikely to travel any appreciable distance to shop at a commissary.

The same procedure was applied to the Hubbell Report data to estimate the value of savings resulting from post exchange privileges.[14] However, the resulting savings appeared unrealistically large and we did not include them.[15]

These non-cash elements of compensation were added to net cash income to get the net total income in each year.

(M) Mortality Adjustment

The present values of the prospective income streams depend upon how long they are to be received. In the income streams which we have used, there are three "open-ended" elements of compensation which continue as long as the individual lives, namely, military retirement pay, the Keogh Plan annuity, and social security benefits. The certainty of eventual death may be incorporated into the calculations in one of two ways: (1) it may be assumed that an individual of a given age will attain the average expected life for all individuals of that age, and the income streams can be projected over that expected life; (2) at any given age, there is a set of probabilities of survival to each succeeding age, and the income streams can be adjusted by these probabilities.

It is possible to have two alternative income streams, with respect to which survival probabilities are invariant, such that the ranking according to present values will differ depending upon the method used to take account of mortality. This can occur when one

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[14] Ibid., Table 6-1, p. 107.

[15] This opinion is shared by the Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs), which also values exchange privileges at zero.

stream has higher incomes in earlier years and the other has higher incomes in later years, which characterizes most of the income streams we analyzed. In fact, this reversal does not occur in the streams we compared, and we do not think it unreasonable for the individual, to whom death is an all-or-nothing event, to evaluate streams on the basis of average life expectancy. However, in our analysis we also evaluate alternatives from the point of view of the Navy, which is an employer of many individuals. Death is not an all-or-nothing event to the Navy. The present value of the Navy's (DoD's) liability for future military retirement payments will vary significantly according to the method used to deal with mortality. Specifically, the present value of the Navy's liability will be higher if it is assumed that all individuals will live for the average expected life than if the probability distribution is used.[16] Use of the former method will bias the results of analysis against any alternative which involves a 20-year Navy career when compared with one which does not. Therefore, we have chosen to adjust expected incomes by survival probabilities from the point of view of both the Navy and the individual.

The income streams of the Navy physician were adjusted by the probabilities of survival shown in table A-8. These are the survival rates for all military officers who retire on nondisability, based on the assumption of no hostile action. The survival rates shown begin at age 35, whereas our income profiles begin earlier; one profile (the scholarship recipient) begins at age 22. We have assumed that the probability of survival until age 35 is 1.0; approximately 96-1/2 percent of all individuals in the U.S. population of age 22 survive until age 35,[17] and survival rates are higher for military officers than the general population, hence this assumption will have a negligible effect on present values. Therefore, starting at age 36, the after-tax incomes as viewed by the physician were multiplied by the probabilities shown in table A-8 before being discounted.[18]

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[16] Consider 10 individuals retiring at a given age for whom the average life expectancy is 30 years. The present value of the Navy's pension liability is based on 10 payment streams of 30 years each. With the average life expectancy given, any departure from this pattern results in transferring a retirement payment from an earlier year to a later one, and hence a lower present value of the liability. Let 8 of the above individuals die in year 30, one in year 29 and one in year 31. The average life expectancy is still 30 years, but a payment is saved in year 29 and an additional payment is made in year 31, lowering the present value of the liability stream.

[17] Commissioners 1958 Standard Ordinary Table of Mortality.

[18] All of the income profiles we examined from the point of view of the physician begin earlier than age 35; the use of these survival probabilities from the Navy's point of view is discussed below.

TABLE A-8

OFFICERS NON-DISABILITY SURVIVAL RATES

Age	ℓ_x*	Age	ℓ_x*
35	100000	72	64631
36	99818	73	61894
37	99621	74	59028
38	99409	75	56037
39	99181	76	52933
40	98935	77	49729
41	98669	78	46442
42	98384	79	43086
43	98076	80	39678
44	97745	81	36250
45	97389	82	32836
46	97005	83	29476
47	96593	84	26213
48	96150	85	23086
49	95674	86	20123
50	95163	87	17349
51	94615	88	14779
52	94026	89	12432
53	93392	90	10315
54	92707	91	8433
55	91963	92	6785
56	91153	93	5366
57	90274	94	4165
58	89319	95	3169
59	88282	96	2360
60	87159	97	1716
61	85939	98	1215
62	84619	99	832
63	83192	100	548
64	81649	101	343
65	79988	102	203
66	78198	103	111
67	76277	104	55
68	74221	105	25
69	72029	106	9
70	69700	107	3
71	67235	108	--

*Number living at age x for 100,000 alive at age 35.

Source: Actuarial Consultant, Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs).

(N) Discounting

The final step was to discount the after-tax incomes (adjusted for mortality) to find the present values of the income streams. The discounting formula used was:

$$\text{Present value} = \frac{A_1}{(1+i)} + \frac{A_2}{(1+i)^2} + \ldots + \frac{A_n}{(1+i)_n} ,$$

where A represents the incomes received in the years indicated by the subscript and i is the discount rate. It was assumed that all sums were received at the end of the year, with the exception of continuation pay. Continuation pay is received in a lump-sum at the beginning of a year, therefore, in tables A-12 and A-13, we list continuation pay in the year before it is actually received. This has the effect of discounting it as of the beginning of the year in which it is received.[19]

The tables used in the text show the present values of the various income streams when discounted at rates of 5, 6, 7, and 10 percent, and also the undiscounted sums of these streams (0 percent discount rate). The discount rate is a measure of the preference for present over future income. While no one will regard a dollar to be received in the future as equivalent to a dollar to be received today, the degree of preference for present over future sums (i.e., the discount rate) will vary among individuals, and even for the same individual at different stages of his lifetime. Younger people are likely to have higher discount rates than older ones. Therefore, a range of discount rates was used to show the sensitivity of our calculations to different assumptions about this rate. In some of our calculations, one alternative had a higher present value at low discount rates, and the other had a higher present value at high discount rates. Higher discount rates generally reduce the present value of a 20-year Navy career relative to other alternatives because of their effect on military retirement pay which is to be received in the distant future.

In comparing the range of discount rates used in this study with observed discount rates, it should be noted that the rates used here are pure time preference rates. Observed discount rates reflect the influence of several factors in addition to time preference, including: (1) anticipations about the future course of the price level; (2) uncertainty about the receipt of future sums; and (3) taxation of future earnings on investments. Our calculations are in real terms, that is, in terms of dollars of constant purchasing power. We have regarded all future sums as to be received with certainty, except for the probability of death, for which an adjustment has been made. Finally, the income streams used are net of taxes. For all these reasons, our discount rates would correspond to observed rates which are higher to some unknown degree.

[19] However, continuation pay is shown in the year in which actually received in the graphs of figures 1 and 2.

II. COMPONENTS OF THE CIVILIAN PHYSICIAN'S INCOME

(A) Tuition

The Navy has estimated the cost of tuition, fees, books, and laboratory expenses at $3,000 per year for scholarship recipients in the budget for fiscal year 1974. We have accepted this estimate for the Navy's outlay stream, and also used it to represent the expenses of the medical student who pays his own educational expenses. This figure appears reasonable in view of the estimated minimum expenses for first-year medical students published by the Association of American Medical Colleges, although it is somewhat high for a student attending a state university in his state of residence.[20] During each of the four years of medical school, $3,000 was entered as a negative item in the income stream of the civilian medical student.[21]

(B) Loans, Grants and Loan Repayments

Loans and grants are available to medical students from a variety of sources. The student seeking assistance in financing his medical education would consider these sources as an alternative to the DoD scholarship. Scholarships and loans under the Health Professions Educational Assistance Act[22] constitute the largest single source of these funds, aside from loans and grants from the family. In 1970, 18 percent of all medical students reported receiving scholarship funds and 26 percent reported receiving loans under this Act. The average amounts received were $964 from scholarships and $1,084 from loans.[23] We have taken these amounts as representative of the amounts a student seeking financing from other than family sources could expect to receive. They have been entered into the income stream during the medical school years as a partial offset to tuition and other expenses.

Scholarships are non-refundable, but loans are repayable following completion of post-graduate training at an interest rate of 3 percent per year, which also begins accruing at that time. Table A-9 shows two loan repayment schedules. The amounts in the first column were used in the all-civilian profile; those in the second column were used in the profile of the physician who entered the DoD scholarship program in his junior year. These amounts were deducted from after-tax incomes during the years of repayment.

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[20] 1973-74 Medical School Adminission Requirements, op. cit. pp. 30-31.

[21] Although the Navy pays these expenses for the scholarship recipient, the $3,000 was not entered into his income stream, for reasons discussed in Section I (A) of this appendix.

[22] Public Law 88-129, 1963, as amended by Public Law 89-290, 1965.

[23] Data supplied to the author by the Division of Manpower Intelligence, National Institutes of Health, Department of Health, Education and Welfare, from the forthcoming report on Survey of Health Professions Student Financing.

TABLE A-9

REPAYMENT SCHEDULE FOR LOANS UNDER THE HEALTH PROFESSIONS EDUCATIONAL ASSISTANCE ACT

Repayment at the end of year	Amount repaid (principal and interest) Loan of $1,084 for 4 years (Total, $4,336)	Loan of $1,084 for 2 years (Total, $2,168)
9	$564	$282
10	551	275
11	538	269
12	525	263
13	512	256
14	499	250
15	486	243
16	473	236
17	460	229
18	447	223

Source: Constructed from information in "A Guide for Repayment, Deferment, and Cancellation of Health Professions Student Loans," National Institutes of Health, Department of Health, Education and Welfare, Washington, D.C.: U.S. Government Printing Office, 1970.

(C) Civilian Intern and Resident Stipends

Our estimates of civilian internship and residency earnings are based on a survey by the Council of Teaching Hospitals.[24] The following annual average stipends were reported for 1971-72: interns, $9,198; first-year residents, $9,892; second-year residents, $10,475; third-year residents, $11,065. We added $1,000 to each of these figures to

[24] COTH Survey of House Staff Policy - 1971, Part 1, Council of Teaching Hospitals, Association of American Medical Colleges, Washington, D.C. September 1971, p. 5.

estimate the 1973 stipends. The incomes of interns and residents increased rapidly over the period 1966-1971, but the rate of increase has diminished since then. Our estimates approximate those reported in a 1973 survey by Hospital Physician.[25] These "stipends" are actually salaries and are subject to income and social security taxes.

(D) Net Income from Practice

In Section III of the text, we noted that one of the difficulties encountered in constructing our model was the selection of a civilian income profile representative of the alternatives open to the prospective or current Navy physician. These incomes vary widely according to type of practice and specialty. Of the total number of active physicians in the United States at the end of 1971, excluding interns and residents, about 73 percent were in office-based practice, 13 percent were in hospital-based practice, and the remainder were engaged in teaching, administration, research and other activities.[26] Office-based physicians clearly constitute the largest class of physicians, but within this group physicians may be organized as incorporated or unincorporated group practices and solo practices.

There are wide variations in income by form of organization, even within the office-based groups. In 1970, the median incomes of incorporated physicians (salary, bonus and retirement contributions) was $62,500, 46 percent higher than the $42,800 median net earnings of self-employed physicians.[27] Data published in Medical Economics on net incomes for 5 specialties in 1970 shows that the median in the highest-income specialty (general surgery) exceeded that in the lowest (pediatrics) by 31 percent.[28] Data published by the AMA on mean net incomes for 7 specialties in 1969 showed incomes of the highest specialty (surgery) to be 54 percent higher than that of the lowest (pediatrics).[29] Incorporation offers tax advantages which are especially attractive to physicians in higher income brackets, and those with high-income specialties are disproportionately represented among incorporated physicians. There has been a sharp trend toward incorporation in the recent years; in 1972, one-third of all physicians under 65 in private practice were incorporated, compared with 8 percent two years earlier; another 20 percent reported plans to incorporate by 1976.[30]

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[25] Hospital Physician, March 1973, pp. 54-56.

[26] Based on data in The Profile of Medical Practice, 1972 edition, Chicago: American Medical Association, 1972, p. 6.

[27] Medical Economics, November 20, 1972, pp. 132-133.

[28] Medical Economics, October 11, 1971, p. 209.

[29] The Profile of Medical Practice, op. cit., p. 66.

[30] Medical Economics, October 9, 1972, pp. 253 ff.

Ideally, we would want recent data on earnings by specialty, years of practice, and organization of practice (incorporated, self-employed and salaried) for physicians practicing full-time during the year. Such a breakdown would require a very large sample size, and it is not surprising that it is not available. We have reviewed the available sources of data and found all wanting in one respect or another. The sources reviewed include: (1) incomes of self-employed physicians (sole proprietorships and partnerships) published by the Internal Revenue Service in Statistics of Income: Business Income Tax Returns; (2) American Medical Association data, most recently for 1969, which is a mixture of incomes of fee-for-service and salaried physicians, published in the 1972 edition of The Profile of Medical Practice;[31] (3) incomes of self-employed physicians published annually by Medical Economics; (4) incomes of hospital staff physicians (excluding interns and residents) and medical school faculty members by years of experience, published in Hospital Physician in December 1970; (5) salaries of full-time medical school faculty by specialty published in the Journal of Medical Education, most recently in the June 1973 issue; and (6) salaries in the Department of Medicine and Surgery of the Veterans Administration, published most recently in "Pay Structure of the Federal Civil Service," June 30, 1971.[32] It is not our purpose to critique each of these here. A comparison and critique of the first three series is to be found in Marcus S. Goldstein, Income of Physicians, Osteopaths and Dentists from Professional Practice, 1965-69.[33]

It was our judgment that incomes in private practice provide the best measure of civilian earnings opportunities and that the best available data for our purposes are those from the Continuing Survey conducted by Medical Economics and published annually in that journal. Data are gathered annually on the net incomes from practice, by years of practice, of self-employed physicians (partners and proprietors) under age 65 who have been in practice for the entire year. The survey data published varies from year to year. Usually, it consists of the median incomes and the range of incomes for five major specialties. Sometimes data are published by years of experience for all specialties. An unusually large sample was taken in the 1966 Survey which permitted tabulation of income by years of practice for 10 major fields in 1965, but unfortunately these incomes are not recent enough for use here.[34] The most recent published data on income by years of

[31] op. cit., pp. 89-93.

[32] United States Civil Service Commission, Washington, D.C.: U.S. Government Printing Office, p. 27.

[33] Office of Research and Statistics, Social Security Administration. Department of Health, Education and Welfare, Washington, D.C.: U.S. Government Printing Office, 1972.

[34] Medical Economics, August 7, 1967, p. 86.

practice were for 1969.[35] We have used unpublished data furnished by Medical Economics to the Department of Defense pertaining to the year 1971, and projected them to the beginning of 1973 by making an upward adjustment of 3 percent.[36] These incomes are shown in table A-10.

TABLE A-10

NET INCOME FROM PRACTICE, SELF-EMPLOYED PHYSICIANS, BY YEARS OF PRACTICE

Years of practice	Net income from practice	
	1971[a]	Beginning of 1973[b]
1-2	$30,700	$31,600
3-5	43,400	44,700
6-10	45,300	46,700
11-20	46,200	47,600
21-30	42,300	43,600
Over 30	34,700	35,700
Median	42,800	44,000

[a]Source: Medical Economics.

[b]1971 data, adjusted upward by 3 percent.

There are two major shortcomings of the data: (1) income profiles are not available by major specialties; and (2) data on incorporated physicians are not included. Within any field, the highest income earners are more likely to incorporate, and physicians in the highest income fields are more likely to incorporate. As a senior editor of Medical Economics has noted, this is an important factor in the relatively low rates of increase in the incomes of self-employed physicians reported in recent surveys. The higher-income physicians have removed themselves from the sample.[37]

[35]Medical Economics, December 21, 1970, p. 70.

[36]The increase in the median income for all specialties from 1970-71 was 3 percent and the expected increase for 1971-72 was 2-3 percent. (Medical Economics, November 20, 1972, pp. 131-2.)

[37]Medical Economics, October 11, 1971, p. 206.

This factor biases our estimates of alternative civilian earnings downwards, and as we have noted, our results are strictly applicable only for physicians whose alternatives are approximated by the all-specialty median. Some of our conclusions may be either reversed or reinforced for those in specialties with incomes higher or lower than the median. For example, we have concluded that investment in the scholarship program has a high return compared with using civilian contract physicians; this may not hold, however, for a relatively low-income specialty such as pediatrics, which, incidentally, is also one amenable to civilianization. Our conclusions about retention at the end of obligated service would also have to be modified; remaining in the Navy would have greater financial attractiveness to a pediatrician than our calculations indicate, and would have less financial attractiveness to a radiologist. Against this, it may be said that our civilian income figures are medians, and half of the physicians get less than this.

However, income profiles by specialty would be useful, particularly for analysis of the civilianization issue and for administration of the bonus. They would aid in determining how much to offer to each specialty and whether to vary the amount at various points during service. Experience will also indicate this, of course, but after the fact. We do think it worth additional work to obtain or construct such data series.

Another objection to the comparison of Navy and civilian physician incomes is that the return of the former is entirely labor income, whereas net income from practice is compounded of returns to labor, capital, and entrepreneurial activity. These returns are empirically difficult to separate and we do not think this objection sufficient to invalidate the use of incomes of self-employed physicians as a measure of alternative earnings. Investment in equipment will, of course, vary among specialties, being relatively great for an office-based radiologist and relatively low for a psychiatrist. We have not seen data on average amounts invested in equipment and buildings by physicians. Our impression is that this return is small relative to the labor component in most specialties. Depreciation is deducted from gross income before arriving at net income, and an examination of depreciation charges claimed on physicians' income tax returns suggests that return on invested capital is not a large component of income.[38]

However, the average hours worked per week are undoubtedly longer for the self-employed civilian physician than for the Navy physician. The standard work week for Navy physicians is 40 hours, although there will be assignments entailing longer hours. Survey data indicate that the average number of hours of practice by civilian physicians

[38] Internal Revenue Service, Statistics of Income: Business Income Tax Returns.

is 51.3 per week, of which 44.7 hours are spent in direct patient care.[39] Of the difference of 6.6 hours, some unknown portion was presumably spent in entrepreneurial activities involved in the business aspects of operating a practice. The 6.6 hours also include time spent in research, teaching, reading, etc. In summary, it appears that the incomes of self-employed physicians are largely attributable to labor.

However, this leads to an additional consideration, for which no adjustment has been made, namely, the fact that self-employed civilian physicians receive their higher incomes for a substantially longer work week. This is an important feature of a Navy medical career which was not taken into account in our calculations, and the effect is to overstate the difference between civilian and Navy incomes during active duty years. One might wish to adjust the civilian after-tax income data by reducing it to, say, 80 percent of the levels we have used to account for this. Another aspect of this is that it is alleged that "moonlighting" is widespread among military physicians. The practice of moonlighting will, of course, vary depending upon the location and assignment, but in most cases the shorter hours certainly make this possible. To the extent that moonlighting occurs, therefore, the labor income of the Navy physician is understated, perhaps by a substantial amount. We know of no source of data on the extent of moonlighting or the incomes derived from it by Navy physicians.

The exclusion of the incomes of incorporated physicians from our data biases our civilian income estimates downward; on the other hand, not adjusting for the shorter hours and/or for moonlighting income biases our Navy income estimates downward. These two factors tend to offset each other with respect to the differential between the two income streams, but we do not know their net effect.

(E) Keogh Plan Contributions and Benefits

Under the Keogh Plan (Public Law 87-792, October 10, 1962), self-employed physicians (and others) may set aside tax-sheltered contributions of up to $2,500 per year in a retirement fund. The earnings on these amounts are also tax-sheltered; an additional $2,500 per year may be contributed on which only the earnings are tax-sheltered. When sums are withdrawn from the fund, they are taxable as ordinary income, and a penalty is levied if sums are withdrawn before the age of 59-1/2.[40] We have assumed that during each year of civilian practice beyond residency training, physicians (including former Navy physicians)

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[39] The Profile of Medical Practice, 1972 edition, op. cit., pp. 52 and 53. The survey respondents were predominantly engaged in fee-for-service practice, but a number of salaried physicians, who work shorter hours, were included. The average number of weeks worked per year was 48, approximately the same as for the Navy physician.

[40] Incorporated physicians may set aside much larger tax-sheltered sums in retirement plans.

contribute $2,500 to a Keogh Plan fund, that these funds are invested at 6 percent interest compounded annually, and that a perpetual annuity is purchased at age 65 with the accumulated sum. The contributions have been deducted from income before estimating income taxes, and the annuities have been treated as ordinary income subject to full taxation.

In this section we shall explain why we followed this procedure and how the estimates were made. Our purpose has been to compare the labor incomes associated with various careers, although net income from practice of self-employed physicians does include some income which is a return on invested capital and which could not be separately identified.

Yet we have included the separable element of property income represented by the return on investment in the retirement plan. This was done to increase the validity of comparisons with a 20-year Navy career. While the Navy physician makes no explicit contribution to his military retirement pay, it is clear that he is accepting a lower salary in the present in exchange for a deferred income. That is, military pay would be higher if each member had to provide for his own retirement.

Even so, it would be neither necessary nor useful to take account of the Keogh Plan were it not for the taxation aspects. If the return on investment were assumed to be the same as the discount rate, transferring income from the present to the future would have no effect upon present value. However, the Keogh Plan enables the physician to defer taxes, and when they are eventually paid, it will be at a lower marginal rate. The marginal tax rate on the $44,000 median income of self-employed physicians is 42 percent, whereas after retirement it will be 32 percent. A current contribution of $2,500 costs the physician only $1,450 (at the median income) because $1,050 would otherwise be taxed away; to put it differently, the physician would have to earn $4,310 in order to net $2,500 to invest in some other form. Therefore, the present value of the civilian physician's income stream will be affected by investment under the Keogh Plan.

Approximately 60 percent of self-employed physicians participate in a Keogh Plan fund. Of those who do participate, the median contribution for all age groups (30-39, 40-49, 50-59, 60-69) was $2,500 per year in 1971. Participation by age group is not known, although it is known that younger men are less likely to contribute.[41] We have assumed that the physician contributes $2,500 per year, even though many younger physicians do not contribute at all. It is an option open to the young civilian physician, and one which will provide him with a retirement income similar to that of the military careerist after age 65. Even at the lowest incomes ($31,600 during the first two years) the marginal tax rate is 32 percent, and a $2,500 contribution costs only $1,700, because $800 would otherwise be taxed away.

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[41] Medical Economics, December 18, 1972, pp. 86-96. A larger percentage of incorporated physicians have tax-sheltered retirement plans. The amount which may be contributed is much greater than under the Keogh Plan; their median contribution (tax-sheltered) was $8,500 in 1971. (Medical Economics, October 9, 1972, pp. 252-265.)

The Keogh Plan fund cannot be drawn upon without penalty until age 59-1/2, and we have assumed that the physician does not draw upon it until he retires at age 65. The annual contributions have been compounded at 6 percent according to the formula:

$$F = \frac{\left[(A + i)^n - 1\right]}{i}$$

where F is the accumulated fund at age 65, A is the annual contribution of $2,500, i is the interest rate (6 percent), and n is the number of years during which contributions are made, which varies according to the career pattern. The 6 percent rate is net of inflation and net of uncertainty as to future receipts.[42] It may be objected that we have used only one compounding rate, 6 percent, whereas we have used discount rates of 5, 6, 7 and 10 percent. It would appear that no one whose discount rate (preference for present over future income) is 10 percent would invest when the expected return is only 6 percent. However, because of tax considerations, such behavior is not necessarily inconsistent. A physician with the median income of $44,000 receives a 6 percent return on $2,500, but the amount sacrificed is only $1,450, therefore the effective yield is much higher than 6 percent.

We have used cross-sectional data in estimating annual Keogh Plan contributions, as we have done throughout our analysis, but there is an objection which applied particularly to this case. The Keogh Plan has only been in effect for 10 years. Although physicians aged 50 and 60 now contribute $2,500 annually, we do not know what their contributions would be if they had begun at age 30. Likewise, the physician who has contributed over an entire career may retire earlier or begin withdrawing funds earlier than age 65. However, we know of no way to overcome this and, in any event, the effect on present values of events so far in the future will not be great.

Finally, we assumed that the accumulated fund was used to purchase a perpetual annuity at age 65. It is possible to set up a fund so that the conversion will not be subject to taxation. The annuity is fully taxable as income during the years in which it is received. We used the cost of purchasing an annuity from the Provident Mutual Life Insurance Company of Philadelphia to convert the accumulated fund to an annuity. At age 65, one may purchase a perpetual annuity of $8.41 per month ($100.92 per year) at a cost of $1,000. There is an initial cost of $75 which we have ignored.[43] This is the basis for converting the funds accumulated at age 65 under several career patterns into the perpetual annuities shown in table A-11.

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[42] The average annual rate of return on Keogh Plan funds used by medical societies has been 8.6 percent over their 9 years of existence. This has not been adjusted for inflation. (Medical Economics, June 25, 1973, pp. 156-161.)

[43] We are indebted to Richard A. Kuzmack for providing this information and his valuable advice on the subject of retirement generally.

TABLE A-11

ACCUMULATED VALUE OF KEOGH PLAN CONTRIBUTIONS AT AGE 65[a] AND CONVERSION TO PERPETUAL ANNUITY

Career Pattern	Accumulated value	Perpetual annuity
All-civilian	$278,587	$28,152
4-year scholarship[b] 20-year Navy career	84,400	8,472
Direct commission, 20-year Navy career	58,190	5,856
2-year scholarship, 6 years active duty[c]	243,358	24,528
4-year scholarship, 8 years active duty[b]	212,004	21,396
4-year scholarship, 9 years active duty[d]	197,645	19,946
4-year scholarship, 10 years active duty[e]	184,099	18,579

[a] It is assumed that $2,500 is contributed during each year of civilian practice after residency training. These sums are compounded at 6% annually until retirement at age 65.

[b] Four-year service obligation, excluding internship and residency.

[c] Two-year service obligation, excluding internship and residency.

[d] Five-year service obligation, excluding internship and residency.

[e] Six-year service obligation, excluding internship and residency.

(F) Social Security Taxes and Benefits

Social security taxes have been deducted from the self-employed physician's income in accordance with the schedule shown in table A-3. Social security benefits have been credited in the same way as for Navy physicians, as discussed in Section I (K) of this appendix.

(G) Mortality Adjustment

The after-tax incomes of civilian physicians were adjusted by mortality probabilities in the same manner as for Navy physicians, as discussed in Section I (M) of this appendix. The military officers non-disability survival rates shown in table A-8 were also used for civilian physicians, even though the life expectancies for military officers at a given age (and hence survival rates) are significantly higher than those for the white male population, as one would expect. We have assumed that a medical student or physician for whom a military career is a real alternative (that is, one who is physically fit to be a military careerist) has the same life expectancy whether or not he elects, in fact, to pursue a military career.

III. COMPONENTS OF THE NAVY'S OUTLAY STREAMS

Although the Navy's outlay streams differ in several respects from the physicians' income streams, they include only one component additional to those discussed in the first two sections of this appendix.

The Navy's outlay for the civilian contract physician was estimated as the median net income for all self-employed physicians, which is about $44,000 per year. For purposes of estimating the Navy's outlay we used the median for all physicians rather than the profile of median incomes by years of experience. It is unlikely that civilian contract billets would be filled exclusively by physicians who have just completed residency and then spend their entire careers as Navy contractors. At any given time, including the outset of a civilianization program, these billets would be filled by physicians with varying degrees of experience, therefore, the overall median represents the best estimate of the Navy's outlay. Because the contract physician is self-employed, there are no additional Navy outlays for "fringe benefits."

The specific components used in the outlay streams for Navy physicians vary according to the career pattern and military compensation assumed, but the following list is exhaustive.

1. Tuition, fees, books, and summer travel (for the scholarship recipient).

2. Base pay (including the stipend of the scholarship recipient).

3. Basic allowance for quarters.

4. Basic allowance for subsistence.

5. Special pay, either at the current level or as proposed in the "Uniformed Services Special Pay Act of 1973."

6. Continuation pay during all unobligated years of service, or a $10,000 bonus during these years, or a $15,000 bonus during the years. Either bonus would be in place of continuation pay under the proposed "Uniformed Services Special Pay Act of 1973."

7. Military retirement pay under the present retirement system for those who complete 20 years of active duty. This is included as a Navy outlay for the purpose of evaluating investments although retirement pay is charged to the budget of the Department of Defense.

8. The social security taxes paid by the Navy on behalf of the military member. These are the same as the taxes paid by the Navy physician.

One major difference between the physician's income stream and the Navy's outlay stream is that all pay and allowances of interns and residents were entered as zero in the Navy's outlay streams. This was the result of an assumption necessary to make a valid comparison between investment in the scholarship program and other alternatives, and is discussed at length in Section V of the text. We also included $400 for travel expenses during the first three years of medical school in the Navy's outlay stream for summer travel to and from a military base. With these two exceptions, the amounts used to estimate the above components are the same as used in the individual physician's income stream. However, in the individual's income streams, we estimated incomes net of taxes, whereas all items are entered gross of taxes in the Navy's outlay streams.

The costs of all non-cash benefits were omitted from the Navy's outlay stream, including the three which were used in the physician's income streams, viz., medical care, disability insurance, and the value of commissary privileges. This is because it is not possible to obtain good estimates of even the average cost of providing these benefits, much less of the marginal cost of providing them to Navy physicians, which is the relevant cost concept. Several other types of costs were omitted, either because they are small or because of difficulties of estimation. These include costs associated with disability retirement, death gratuities, recruitment, and transportation of goods and persons during accession, rotation, and separation moves.

Prior to discounting, the Navy's outlay streams were also adjusted for mortality probabilities, but this was done in a different way than for the individual physician. As discussed in Section I (M) of this appendix, survival probabilities were applied to the physician's incomes beginning at age 35, the earliest age from which they are available for military officers. All Navy physician careers begin at an earlier age, and we assumed the probability of survival until age 35 was 1.0. In most of our comparisons, one of the alternatives was a 20-year Navy career, and we were interested in evaluating the Navy's investment if the physician did in fact live until retirement age.[44] The 20th year of active duty occurs at age 45 in the scholarship recipient profile and at age 49 in the post-resident profile. Therefore, we adapted the survival rates shown in table A-8, using the numbers living at ages 45 and 49 as the base. Thus, the table shows that of 100,000 officers living at age 35, 97,389 would still be alive at age 45. We divided all subsequent numbers in the table by 97,389 in order to estimate the numbers surviving to subsequent years of the cohort living at age 45. Similarly, we used age 49 as the base for post-residents. The retirement outlay stream was then multiplied by these probabilities before being discounted.

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[44] It is clear from our results that the return on the Navy's investment in the scholarship program compared with any of the alternatives examined would be very high if the physician died between age 35 and retirement. Indeed, the return would be extraordinary in the case of the physician who dies during the 20th year of active duty!

The procedure used to evaluate the Navy's investment was also slightly different than that used in calculating the present values of alternative careers from the individual's point of view. We did calculate the present value of investment in the scholarship program at a 10 percent discount rate, using the formula given in Section I (N) of this appendix, but not at other discount rates. Instead, we calculated the rate of return over cost on the Navy's investment, using the formula given in Section V of the text. This procedure yields more information in that it indicates all discount rates at which the Navy's investment has a positive present value. If the appropriate rate of return for the Navy is considered to be anywhere within the range of rates resulting in positive present values, the investment should be undertaken according to the decision rule for efficient intertemporal resource allocation.

Since the use of the rate of return over cost yields more information from the Navy's point of view than the calculation of present values at various rates, one may ask why the same procedure was not followed when evaluating the individual's choice of careers. In the case of the medical student, let us consider the all-civilian career as the investment because it entails outlays (negative items) in the early years, whereas acceptance of a scholarship does not.[45] The results presented in Section IV show that investment in one's own medical education has a lower present value than accepting a scholarship at discount rates from 0 to 10 percent for each comparison made, regardless of the military compensation or career pattern (initial tour or 20 years) assumed. The stream of differences between the civilian and Navy (present pay) careers exhibits three reversals of sign, and there are three crossover rates, all negative. Yet one would not conlcude that no one would invest in their own medical education if a DoD scholarship were available. Therefore, a preferable procedure was to calculate the present values of two career streams in order to see whether the scholarship program and/or the bonus legislation would enable the Navy to offer an income stream of comparable or higher value than the civilian stream.

Finally, there was one difference in the discounting procedure with respect to the treatment of continuation pay. As noted above, continuation pay is paid in a lump sum at the beginning of the year, therefore, we entered it during the year prior to which paid in the physician's income stream. In the Navy's outlay stream, continuation pay was included in the year in which paid (i.e., it was discounted as if paid at the end of the year). This was inadvertent and was discovered too late to be corrected. The effect on calculations of the Navy's return on investment is minor.

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[45] In accordance with our discussion in Section V of the text, neither of these alternatives can be unambiguously considered as an investment relative to the other. This is also true for all other sets of career choices we analyzed. As inspection of the graphs in Section IV shows, there are always at least two reversals of sign in the stream of differences between any set of alternatives considered, and sometimes there are three.

IV. NUMERICAL ESTIMATES, REPLICATION OF RESULTS, AND SUBSTITUTION OF OTHER DATA

Our intent in compiling this appendix is to provide the reader with all of the data needed to replicate our results and to use our methodology with different data, or different assumptions, or for different career patterns. Tables A-12 through A-17 at the end of this appendix, present most of the numerical data underlying our calculations; additional necessary data are contained in other tables in this appendix.

As we have discussed, there are numerous pitfalls involved in dealing with income streams so complex, therefore, we think it useful to illustrate in more detail than was done in the text how some of these results were obtained. We shall use one example of the calculation of present value from the physician's point of view and two examples of the calculations of the Navy's return on investment.

(A) Present Value of a Career to the Individual

First we discuss the calculation of the present value of the income stream of a medical student who is considering accepting a 4-year DoD scholarship and leaving the Navy for civilian practice as soon as his obligated service is completed. This will be at the end of the 8th year of active duty and at the end of the 12th year in the income profile shown in table A-12. We assume the current military pay scale.

First, we calculate his after-tax income for each year over his entire lifetime. During the first 12 years, we add the items subject to income tax from table A-12. These consist only of base pay and special pay for these[46] years, which were added to get adjusted gross income. Table A-2 shows at a glance the federal income tax to be deducted during these years, and table A-12 shows the social security taxes to be deducted. From table A-12, we add the basic allowances for quarters and subsistence to get net cash pay, and the value of medical care, disability insurance, and commissary privileges to get total income net of taxes.

During years 13 through 43, the physician is engaged in private practice. From table A-14, we enter net income from practice during these years, and deduct the tax-sheltered Keogh Plan contributions to get adjusted gross income. Federal income tax (table A-2)

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[46] The scholarship stipend is included in base pay for the first 4 years. It will be noted that the table contains an entry for continuation pay in year 12. However, this is not included, for it pertains only to the physician who remains beyond the end of obligated service. The first unobligated year is year 13, but continuation pay is shown in year 12 because it is received in a lump sum at the beginning of year 13. Most items of pay are received at regular intervals throughout the year, but in our discounting formula we have treated them as though they occur at the end of the year. Continuation pay is an exception, and discounting it as of the end of year 12 is equivalent to discounting it at the beginning of year 13.

and social security tax (table A-14) are deducted to get after-tax income. It will be noted that table A-14 contains an item for loan repayments, but this pertains to the all-civilian career and is not entered in this pattern.

The physician retires completely in year 44, and he begins to receive his Keogh Plan benefits in the form of a perpetual annuity. These are taxable as ordinary income because previous contributions and accumulated earnings were tax-sheltered. However, the amounts shown in table A-14 cannot be used for this pattern because they pertain to the physician who pursued an all-civilian career and contributed $2500 annually during the years 9 through 43. For the career being evaluated, contributions of $2500 annually were made during the years 13 through 43, therefore the accumulated fund upon retirement will be smaller as will the annuity which can be purchased with that fund. Therefore, the annuity must be recalculated using the formula given in Section B of this appendix. The annuity is $21,396 (table A-11) instead of the $28,152 shown in table A-14. Income taxes are deducted from this, again using table A-2, and social security benefits are added (table A-14) to get the after-tax incomes.

The after-tax income during the last year (year 48) will continue as long as the man lives. We have extended this income through the year 107. We now have the lifetime stream of after-tax incomes associated with this career pattern. Next, we multiply these incomes by the survival probabilities shown in table A-8, beginning at age 35. The final step is to discount these adjusted streams at various rates to get the present values, using the formula given in Section I of this appendix.

(B) Return on the Navy's Investment

The first illustration will be the calculation of the Navy's return on investment in the scholarship program (under the assumptions of present military pay and a 20-year career) compared with the alternative of hiring a civilian contractor. The stream of differences between the Navy's outlays on each of these alternatives is shown in Column 3 of table A-16. Outlays for the civilian contractor of $44,000 per year were entered for the years 9 through 24, the same years that the scholarship recipient would be serving as a post-resident. The outlay stream for the scholarship recipient was constructed from data shown in table A-12 plus tuition and other expenses during medical school. During the four medical school years, the Navy's outlay consists of the sum of base pay, tuition payments and summer travel expenses, and social security taxes paid on the individual's behalf. (These are identical to the taxes paid by the individual during these years.) Zero is entered during the years of internship and residency (years 5 through 8) for reasons discussed in Section V of the text. During the remaining active duty years (9 through 24) the items entered were base pay, basic allowance for quarters, basic allowance for subsistence, current special pay, continuation pay, and social security taxes. These were all entered during the years shown in table A-12, except for continuation pay, which was entered in the year actually paid, that is, in years 13-24 instead of 12-23, as shown in the table. Finally, retirement

pay was entered for the years 25 through 85. Only retirement pay was adjusted for survival probabilities, as explained in Section III of this appendix. For this purpose, the survival rates shown in table A-8 were adapted, using age 45 as a base.

The stream of outlays for the scholarship recipient was next deducted from that for the civilian to get the stream of differences, which is shown in column (3) of table A-16. This stream was then discounted to get the present value at 10 percent. The internal rate of return (in this case, there were two) was then calculated.

A separate table (A-17) was prepared to show how the comparison was made between investment in a succession of four scholarship recipients, each of whom leaves after the initial obligated tour, with one scholarship recipient who remains for a 20-year career and then retires. The items entered into the outlay streams in any given year were calculated in the manner just indicated. First, we present the outlay stream for the scholarship recipient who remains for 20 years. Then we show the annual outlays for each of the four scholarship recipients, who have been phased in so that one year of post-resident service is provided during the same years (9 through 24) as it is provided by the careerist. The outlays for the succession of scholarship recipients are then totaled and subtracted from the outlays for the careerist to get the stream of differences. The stream of differences is then discounted at several rates and the Navy's return on investment is also calculated.

TABLE A-12

NUMERICAL ESTIMATES OF COMPONENTS OF LIFETIME INCOME STREAMS OF DOD SCHOLARSHIP RECIPIENTS[1]

Year	BPY	BAQ	BAS	MED	DIS	COM	SPC	CPC[2]	SPP	B10	B15	RPC	SSB	PRC	SST	KPC	DPB	ℓ_x
1	5308	0	0	0	0	0	0	0	0	0	0	0	0	0	-311	0	0	1.0000
2	5308	0	0	0	0	0	0	0	0	0	0	0	0	0	-311	0	0	1.0000
3	5340	0	0	0	0	0	0	0	0	0	0	0	0	0	-312	0	0	1.0000
4	5340	0	0	0	0	0	0	0	0	0	0	0	0	0	-312	0	0	1.0000
5	11873	2347	575	0	50	231	0	0	0	0	0	0	0	0	-694	0	0	1.0000
6	11873	2347	575	0	50	231	1200	0	1200	0	0	0	0	0	-718	0	0	1.0000
7	12438	2347	575	0	50	260	1800	0	4200	0	0	0	0	0	-726	0	0	1.0000
8	12776	2585	575	0	50	260	1800	0	4200	0	0	0	0	0	-726	0	0	1.0000
9	13345	2585	575	416	163	260	1800	0	4200	0	0	0	0	0	-738	0	0	1.0000
10	13345	2585	575	416	163	260	1800	0	4200	0	0	0	0	0	-738	0	0	1.0000
11	14252	2585	575	416	163	329	3000	0	4200	0	0	0	0	0	-738	0	0	1.0000
12	14252	2585	575	416	163	329	3000	5206	4200	0	0	0	0	0	-738	0	0	1.0000
13	15617	2866	575	416	163	363	3000	5206	4200	10000	15000	0	0	0	-750	0	0	0.9982
14	15617	2866	575	416	163	441	3000	5554	4200	10000	15000	0	0	0	-750	0	0	0.9962
15	16661	2866	575	416	163	441	4200	5554	4200	10000	15000	0	0	0	-750	0	0	0.9941
16	16661	2866	575	416	163	441	4200	5970	4200	10000	15000	0	0	0	-750	0	0	0.9918
17	17910	2866	575	416	163	441	4200	5970	4200	10000	15000	0	0	0	-750	0	0	0.9893
18	17910	2866	575	416	163	441	4200	6313	4200	10000	15000	0	0	0	-750	0	0	0.9867
19	18940	2866	575	446	222	441	4200	7037	4200	10000	15000	0	0	0	-750	0	0	0.9838
20	21110	3100	575	446	222	441	4200	7189	4200	10000	15000	0	0	0	-750	0	0	0.9808
21	21567	3100	575	446	222	441	4200	7189	4200	10000	15000	0	0	0	-750	0	0	0.9774
22	21567	3100	575	446	222	441	4200	7608	4200	10000	15000	0	0	0	-750	0	0	0.9739
23	22824	3100	575	446	222	441	4200	7608	4200	10000	15000	0	0	0	-750	0	0	0.9700
24	22824	3100	575	446	222	441	4200	0	4200	10000	15000	0	0	0	-750	0	0	0.9659
25	0	0	0	446	0	0	0	0	0	0	0	18355	0	47600	-1014	-2500	0	0.9615
26	0	0	0	446	0	0	0	0	0	0	0	18355	0	47600	-1014	-2500	0	0.9567
27	0	0	0	446	0	0	0	0	0	0	0	18355	0	47600	-1014	-2500	0	0.9516
28	0	0	0	446	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9461
29	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9403
30	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9339
31	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9271
32	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9196
33	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9115
34	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.9027
35	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.8932
36	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.8828
37	0	0	0	499	0	0	0	0	0	0	0	18355	0	43600	-1014	-2500	0	0.8716
38	0	0	0	499	0	0	0	0	0	0	0	18355	0	35700	-1014	-2500	0	0.8594
39	0	0	0	445	0	0	0	0	0	0	0	18355	0	35700	-1014	-2500	0	0.8462
40	0	0	0	445	0	0	0	0	0	0	0	18355	0	35700	-1014	-2500	0	0.8319
41	0	0	0	445	0	0	0	0	0	0	0	18355	0	35700	-1014	-2500	0	0.8165
42	0	0	0	445	0	0	0	0	0	0	0	18355	0	35700	-1014	-2500	0	0.7999
43	0	0	0	445	0	0	0	0	0	0	0	18355	4860	0	0	0	8472	0.7820
44	0	0	0	445	0	0	0	0	0	0	0	18355	4860	0	0	0	8472	0.7628
45	0	0	0	445	0	0	0	0	0	0	0	18355	4860	0	0	0	8472	0.7422
46	0	0	0	445	0	0	0	0	0	0	0	18355	4860	0	0	0	8472	0.7203
47[3]	0	0	0	445	0	0	0	0	0	0	0	18355	7284	0	0	0	8472	0.6970
48	0	0	0	445	0	0	0	0	0	0	0	18355	7284	0	0	0	8472	0.6970

[1] Prior to adjustment for survival probabilities.
[2] Continuation pay is received in a lump sum at the beginning of the year following the year shown.
[3] Data for this year apply to all subsequent years.

TABLE A-13

NUMERICAL ESTIMATES OF COMPONENTS OF LIFETIME INCOME STREAMS OF POST-RESIDENTS ACCEPTING DIRECT COMMISSIONS[1, 2]

Year	BPY	BAQ	BAS	MED	DIS	COM	SPC	CPC[3]	SPP	B10	B15	RPC	SSB	PRC	SST	KPC	KPB	ℓ_x
1	13345	2585	575	416	163	260	1200	0	1200	10000	15000	0	0	0	-632	0	0	1.0000
2	13345	2585	575	416	163	329	1200	4751	1200	10000	15000	0	0	0	-702	0	0	1.0000
3	14252	2585	575	416	163	329	1800	4751	4200	10000	15000	0	0	0	-702	0	0	1.0000
4	14252	2585	575	416	163	329	1800	5020	4200	10000	15000	0	0	0	-702	0	0	1.0000
5	15059	2585	575	416	163	441	1800	5206	4200	10000	15000	0	0	0	-702	0	0	1.0000
6	15617	2866	575	416	163	441	1800	5554	4200	10000	15000	0	0	0	-726	0	0	0.9982
7	16661	2866	575	416	163	441	3000	5554	4200	10000	15000	0	0	0	-726	0	0	0.9962
8	16661	2866	575	416	163	441	3000	5970	4200	10000	15000	0	0	0	-726	0	0	0.9941
9	17910	2866	575	416	163	441	3000	5970	4200	10000	15000	0	0	0	-738	0	0	0.9918
10	17910	2866	575	416	163	441	3000	6313	4200	10000	15000	0	0	0	-738	0	0	0.9893
11	18940	2866	575	446	222	441	4200	6313	4200	10000	15000	0	0	0	-738	0	0	0.9867
12	18940	2866	575	446	222	441	4200	7189	4200	10000	15000	0	0	0	-738	0	0	0.9838
13	21568	3100	575	446	222	441	4200	7189	4200	10000	15000	0	0	0	-738	0	0	0.9808
14	21568	3100	575	446	222	441	4200	7608	4200	10000	15000	0	0	0	-750	0	0	0.9774
15	22824	3100	575	446	222	441	4200	7608	4200	10000	15000	0	0	0	-750	0	0	0.9739
16	22824	3100	575	446	222	441	4200	7608	4200	10000	15000	0	0	0	-750	0	0	0.9700
17	22824	3100	575	446	222	441	4200	7608	4200	10000	15000	0	0	0	-750	0	0	0.9659
18	22824	3100	575	446	222	441	4200	8250	4200	10000	15000	0	0	0	-750	0	0	0.9615
19	24750	3100	575	446	222	441	4200	8250	4200	10000	15000	0	0	0	-750	0	0	0.9567
20	24750	3100	575	446	222	441	4200	0	4200	10000	15000	0	0	0	-750	0	0	0.9516
21	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9461
22	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9403
23	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9339
24	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9271
25	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9196
26	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9115
27	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.9027
28	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.8932
29	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.8828
30	0	0	0	499	0	0	0	0	0	0	0	18389	0	43600	-1014	-2500	0	0.8716
31	0	0	0	445	0	0	0	0	0	0	0	18389	0	35700	-1014	-2500	0	0.8594
32	0	0	0	445	0	0	0	0	0	0	0	18389	0	35700	-1014	-2500	0	0.8462
33	0	0	0	445	0	0	0	0	0	0	0	18389	0	35700	-1014	-2500	0	0.8319
34	0	0	0	445	0	0	0	0	0	0	0	18389	0	35700	-1014	-2500	0	0.8165
35	0	0	0	445	0	0	0	0	0	0	0	18389	0	35700	-1014	-2500	0	0.7999
36	0	0	0	445	0	0	0	0	0	0	0	18389	4860	0	0	0	5856	0.7820
37	0	0	0	445	0	0	0	0	0	0	0	18389	4860	0	0	0	5856	0.7628
38	0	0	0	445	0	0	0	0	0	0	0	18389	4860	0	0	0	5856	0.7422
39	0	0	0	445	0	0	0	0	0	0	0	18389	4860	0	0	0	5856	0.7203
40[4]	0	0	0	445	0	0	0	0	0	0	0	18389	7264	0	0	0	5856	0.6970

[1] See footnotes to table A-12 for legend.

[2] Prior to adjustment for survival probabilities.

[3] Continuation pay is received in a lump sum at the beginning of the year following the year shown.

[4] Data for this year apply to all subsequent years.

LEGEND FOR TABLES A-12 AND A-13

YEAR – First year is assumed to be 1973.

BPY – Military base pay

BAQ – Basic allowance for quarters

BAS – Basic allowance for subsistence

MED – Value of medical care

DIS – Value of military disability retirement system

COM – Value of commissary privileges

SPC – Special pay, current

CPC – Continuation pay, current

SPP – Special pay, proposed

B10 – $10,000 annual bonus, proposed

B15 – $15,000 annual bonus, proposed

RPC – Military retirement pay, current system, adjusted

SSB – Social security benefits

PRC – Post-retirement career income; same as net income from practice for civilians

SST – Social security taxes

KPC – Keogh Plan contributions, tax-sheltered

KPB – Keogh Plan benefits, perpetual annuity

ℓ_x – Survival rates; number living at age x for 100,000 alive at age 35

TABLE A-14

NUMERICAL ESTIMATES OF COMPONENTS OF LIFETIME INCOME STREAMS OF CIVILIAN PHYSICIANS, FROM ENTRY INTO MEDICAL SCHOOLS[1]

Year	NIP	KPC	KPB	SSB	SST	TTN	MSG	MSL	LRP	ℓ_x
1	0	0	0	0	0	-3000	964	1084	0	1.0000
2	0	0	0	0	0	-3000	964	1084	0	1.0000
3	0	0	0	0	0	-3000	964	1084	0	1.0000
4	0	0	0	0	0	-3000	964	1084	0	1.0000
5	10198	0	0	0	-597	0	0	0	0	1.0000
6	10892	0	0	0	-659	0	0	0	0	1.0000
7	11475	0	0	0	-694	0	0	0	0	1.0000
8	12065	0	0	0	-726	0	0	0	0	1.0000
9	31600	-2500	0	0	-1002	0	0	0	-564	1.0000
10	31600	-2500	0	0	-1002	0	0	0	-551	1.0000
11	44700	-2500	0	0	-1002	0	0	0	-538	1.0000
12	44700	-2500	0	0	-1002	0	0	0	-525	1.0000
13	44700	-2500	0	0	-1002	0	0	0	-512	1.0000
14	46700	-2500	0	0	-1014	0	0	0	-499	0.9982
15	46700	-2500	0	0	-1014	0	0	0	-486	0.9962
16	46700	-2500	0	0	-1014	0	0	0	-473	0.9941
17	46700	-2500	0	0	-1014	0	0	0	-460	0.9918
18	46700	-2500	0	0	-1014	0	0	0	-447	0.9893
19	47600	-2500	0	0	-1014	0	0	0	0	0.9867
20	47600	-2500	0	0	-1014	0	0	0	0	0.9838
21	47600	-2500	0	0	-1014	0	0	0	0	0.9808
22	47600	-2500	0	0	-1014	0	0	0	0	0.9774
23	47600	-2500	0	0	-1014	0	0	0	0	0.9739
24	47600	-2500	0	0	-1014	0	0	0	0	0.9700
25	47600	-2500	0	0	-1014	0	0	0	0	0.9659
26	47600	-2500	0	0	-1014	0	0	0	0	0.9615
27	47600	-2500	0	0	-1014	0	0	0	0	0.9567
28	47600	-2500	0	0	-1014	0	0	0	0	0.9516
29	43600	-2500	0	0	-1014	0	0	0	0	0.9461
30	43600	-2500	0	0	-1014	0	0	0	0	0.9403
31	43600	-2500	0	0	-1014	0	0	0	0	0.9339
32	43600	-2500	0	0	-1014	0	0	0	0	0.9271
33	43600	-2500	0	0	-1014	0	0	0	0	0.9196
34	43600	-2500	0	0	-1014	0	0	0	0	0.9115
35	43600	-2500	0	0	-1014	0	0	0	0	0.9027
36	43600	-2500	0	0	-1014	0	0	0	0	0.8932
37	43600	-2500	0	0	-1014	0	0	0	0	0.8828
38	43600	-2500	0	0	-1014	0	0	0	0	0.8716
39	35700	-2500	0	0	-1014	0	0	0	0	0.8594
40	35700	-2500	0	0	-1014	0	0	0	0	0.8462
41	35700	-2500	0	0	-1014	0	0	0	0	0.8319
42	35700	-2500	0	0	-1014	0	0	0	0	0.8165
43	35700	-2500	0	0	-1014	0	0	0	0	0.7999
44	0	0	28152	4860	0	0	0	0	0	0.7820
45	0	0	28152	4860	0	0	0	0	0	0.7628
46	0	0	28152	4860	0	0	0	0	0	0.7422
47	0	0	28152	4860	0	0	0	0	0	0.7203
48[2]	0	0	28152	7284	0	0	0	0	0	0.6970

[1] Prior to adjustment for survival probabilities.

[2] Data for this year apply to all subsequent years.

LEGEND FOR TABLE A-14

YEAR – First year is assumed to be 1973

NIP – Net income from practice, self-employed physician

KPC – Keogh Plan contributions, tax-sheltered

KPB – Keogh Plan benefits, perpetual annuity

SSB – Social security benefits

SST – Social security taxes

TTN – Medical school tuition, fees and expenses

MSG – Scholarship during medical school

MSL – Loans during medical school

LRP – Repayment of medical school loans

ℓ_x – Survival rates; number living at age x for 100,000 alive at age 35

TABLE A-15

AFTER-TAX INCOME STREAMS ASSOCIATED WITH VARIOUS CAREER PATTERNS[1]

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	4663	4663	4663	-952	-952	4663	4663	4663	0	0	0	0	16279	27860	24120	23184
2	4663	4663	4663	-952	-952	4663	4663	4663	0	0	0	0	19989	27859	24119	23088
3	4692	4692	4692	-952	4692	4692	4692	4692	0	0	0	0	21171	30384	27006	32160
4	4692	4692	4692	-952	4692	4692	4692	4692	0	0	0	0	21253	30384	27006	32160
5	13145	13145	13145	8842	13145	13145	13145	13145	0	0	0	0	22171	31033	27685	32160
6	14068	14068	14068	9209	14068	14068	14068	14068	0	0	0	0	23334	31848	28500	33290
7	15111	16983	16983	9544	15111	15111	15111	15111	0	0	0	0	24822	32604	29000	33290
8	15687	17559	17559	9987	15687	15687	15687	15687	0	0	0	0	25238	32604	29000	33290
9	16399	18483	18483	22482	16117	16399	16399	16399	0	0	0	0	26265	33265	29687	33278
10	16399	18483	18483	22495	16124	16399	16399	16399	0	0	0	0	26374	33265	29687	33278
11	18259	19284	19284	31580	31849	18259	18259	18259	0	0	0	0	28213	34072	30518	33968
12	22416	19284	19284	31593	31855	18259	18259	18259	0	0	0	0	28545	34072	30518	33968
13	23886	31758	28410	31606	31862	32118	19764	19764	23886	31758	28410	32118	30857	36154	32822	33968
14	24090	31824	28476	32767	33016	33266	33266	19794	24090	31824	28476	33266	30976	36142	32810	33956
15	25788	32580	28976	32780	33023	33266	33266	33266	25788	32580	28976	33266	31962	36978	33490	33956
16	26204	32580	28976	32793	33030	33266	33266	33266	26204	32580	28976	33266	31962	36978	33490	33956
17	26979	33253	29675	32806	33037	33266	33266	33266	26979	33253	29675	33266	31962	36978	33490	33956
18	27322	33253	29675	32819	33043	33266	33266	33266	27322	33253	29675	33266	32316	36978	33490	33956
19	28381	34060	30506	33956	33955	33956	33956	33956	28381	34060	30506	33956	33666	38484	35104	33956
20	30387	35684	32352	33956	33956	33956	33956	33956	30387	35684	32352	33956	28172	38484	35104	33956
21	30844	36141	32809	33956	33956	33956	33956	33956	30844	36141	32809	33956	43164	43164	43164	31216
22	30975	36141	32809	33956	33956	33956	33956	33956	30975	36141	32809	33956	43164	43164	43164	31216
23	31962	36978	33490	33956	33956	33956	33956	33956	31962	36978	33490	33956	43164	43164	43164	31216
24	26486	36978	33490	33956	33956	33956	33956	33956	26486	36978	33490	33956	43164	43164	43164	31216
25	45445	45445	45445	33956	33956	33956	33956	33956	45445	45445	45445	33956	43164	43164	43164	31216
26	45445	45445	45445	33956	33956	33956	33956	33956	45445	45445	45445	33956	43164	43164	43164	31216
27	45445	45445	45445	33956	33956	33956	33956	33956	45445	45445	45445	33956	43164	43164	43164	31216
28	45445	45445	45445	33956	33956	33956	33956	33956	45445	45445	45445	33956	43164	43164	43164	31216
29	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	43164	43164	43164	31216
30	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	43164	43164	43164	31216
31	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	38400	38400	38400	25752
32	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	38400	38400	38400	25752
33	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	38400	38400	38400	25752
34	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	38400	38400	38400	25752
35	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	38400	38400	38400	25752
36	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	25758	25758	25758	28200
37	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	25758	25758	25758	28200
38	43130	43130	43130	31216	31216	31216	31216	31216	43130	43130	43130	31216	25758	25758	25758	28200
39	38366	38366	38366	25752	25752	25752	25752	25752	38366	38366	38366	25752	25758	25758	25758	28200
40	38366	38366	38366	25752	25752	25752	25752	25752	38366	38366	38366	25752	28182	28182	28182	30624
41	38366	38366	38366	25752	25752	25752	25752	25752	38366	38366	38366	25752	28182	28182	28182	30624
42	38366	38366	38366	25752	25752	25752	25752	25752	38366	38366	38366	25752	28182	28182	28182	30624
43	38366	38366	38366	25752	25752	25752	25752	25752	38366	38366	38366	25752	28182	28182	28182	30624
44	27794	27794	27794	28200	25596	23071	22133	20941	27794	27794	27794	23070	28182	28182	28182	30624
45	27794	27794	27794	28200	25596	23071	22133	20941	27794	27794	27794	23070	28182	28182	28182	30624
46	27794	27794	27794	28200	25596	23071	22133	20941	27794	27794	27794	23070	28182	28182	28182	30624
47	27794	27794	27794	28200	25596	23071	22133	20941	27794	27794	27794	23070	28182	28182	28182	30624
48[2]	30218	30218	30218	30624	28020	25495	24557	23365	30218	30218	30218	25494	28182	28182	28182	30624

[1] Prior to adjustment for survival probabilities.

[2] Data for this year apply to all subsequent years for all income streams.

LEGEND FOR TABLE A-15

Column	Career Pattern and Compensation Assumptions
(1)	4-year scholarship and obligation, 20-year Navy career, current military pay
(2)	4-year scholarship and obligation, 20-year career, proposed pay, $15,000 bonus all unobligated years
(3)	4-year scholarship and obligation, 20-year career, proposed pay, $10,000 bonus all unobligated years
(4)	All-civilian career, from entry into medical school
(5)	2-year scholarship and obligation, current military pay, leaves at EOS, from entry into medical school
(6)	4-year scholarship and obligation, current military pay, leaves at EOS, from entry into medical school
(7)	4-year scholarship, 5-year obligation, current military pay, leaves at EOS, from entry into medical school
(8)	4-year scholarship, 6-year obligation, current military pay, leaves at EOS, from entry into medical school
(9)	At EOS, remains in Navy for 20-year career, present pay
(10)	At EOS, remains in Navy for 20-year career, proposed pay, $15,000 bonus all remaining years
(11)	At EOS, remains in Navy for 20-year career, proposed pay, $10,000 bonus all remaining years
(12)	At EOS, scholarship recipient leaves Navy
(13)	Post-resident accepts direct commission, 20-year career, present military pay
(14)	Post-resident accepts direct commission, 20-year career, proposed pay, $15,000 bonus all years
(15)	Post-resident accepts direct commission, 20-year career, proposed pay, $10,000 bonus all years
(16)	Post-resident, civilian career

TABLE A-16

DIFFERENCES IN NAVY OUTLAYS FOR SCHOLARSHIP PROGRAM AND TEN ALTERNATIVES AND PRESENT VALUES AT 10% AND RATES OF RETURN ON INVESTMENT IN SCHOLARSHIP PROGRAM[1]

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	-9019	-9052	-9019	-9019	-9019	-9019	-9019	-9019	-9019	0
2	-9019	-8652	-9019	-9019	-9019	-9019	-9019	-9019	-9019	0
3	-9052	0	-9052	-9052	-9052	-9052	-9052	-9052	-9052	0
4	-8652	0	-8652	-8652	-8652	-8652	-8652	-8652	-8652	0
5	0	0	0	0	0	0	0	0	0	-9019
6	0	0	0	0	0	0	0	0	0	-9019
7	0	24957	0	0	0	0	0	0	0	-9052
8	0	24957	0	0	0	0	0	0	0	-8652
9	24957	0	24957	22557	22557	22557	28537	11678	16678	-9019
10	24957	0	24957	22557	22557	22557	29270	12541	17541	-9019
11	22850	0	22850	21650	21650	21650	28891	12678	17678	-9052
12	22850	0	22850	21650	21650	21650	29629	12678	17678	-8652
13	0	0	15998	10004	5004	20004	13337	2293	2293	-60
14	0	0	15986	9992	4992	19956	14060	2281	2281	-48
15	0	0	13394	8948	3948	3948	13405	2267	2267	404
16	0	0	13394	8948	3948	3948	14140	2267	2267	804
17	0	0	11729	7699	2699	2699	13140	3880	3880	13228
18	0	0	11729	7699	2699	2699	13870	3892	3892	13228
19	0	0	10356	6669	1669	1669	13117	4118	4118	12494
20	0	0	7228	4265	-735	-735	10388	1714	1714	15622
21	0	0	6619	3808	-1192	-1192	10377	1257	1257	18338
22	0	0	6619	3808	-1192	-1192	11056	1257	1257	18338
23	0	0	4943	2551	-2449	-2449	9768	1926	1926	17907
24	0	0	4943	2551	-2449	-2449	10435	1926	1926	17907
25[2]	0	0	-18355	-18355	-18355	-18355	-18355	34[3]	34[3]	18355
Present Values at 10%	7133	9070	15520	3627	-7228	1057	25601	-5208	2186	2084
Rates of Return	13.1	18.8	5.2 17.6	7.8 14.1		9.2 13.4	4.0 19.8	1.2 7.4	0 10.9	10.4

[1]Column headings correspond with comparison numbers of table 10 in text. See table 10 for description of alternatives compared.

[2]Data pertain to years 25 through 85, prior to adjustment for survival probabilities.

[3]For years 25 through 81; amount for years 82 through 85 is -18,355. (See p. 38 of text for explanation.)

TABLE A-17

INVESTMENT IN FOUR SCHOLARSHIPS, INITIAL TOUR ONLY
COMPARED WITH ONE SCHOLARSHIP AND 20-YEAR CAREER

Years	Outlays for one scholarship Recipient, 20-year career	Outlays for four scholarship recipients, initial tour only					Differences[a]
		First	Second	Third	Fourth	Total	
1-2	$ 9,019	$ 9,019				$ 9,019	0
3	9,052	9,052				9,052	0
4	8,652	8,652				8,652	0
5-6	0	0	$ 9,019			9,019	-9,019
7	0	0	9,052			9,052	-9,052
8	0	0	8,652			8,652	-8,652
9-10	19,043	19,043	0	$ 9,019		28,062	-9,019
11	21,150	21,150	0	9,052		30,202	-9,052
12	21,150	21,150	0	8,652		29,802	-8,652
13	28,002		19,043	0	$ 9,019	28,062	-60
14	28,014		19,043	0	9,019	28,062	-48
15	30,606		21,150	0	9,052	30,202	404
16	30,606		21,150	0	8,652	29,802	804
17-18	32,271			19,043	0	19,043	13,228
19	33,644			21,150	0	21,150	12,494
20	36,772			21,150	0	21,150	15,622
21-22	37,381				19,043	19,043	18,338
23-24	39,057				21,150	21,150	17,907
25-85[b]	18,355						18,355

Rate of return on investment in four scholarships:[c] 10.4%

Present value of investment in four scholarships:[c] at discount rate of 5% = $81,536
" " 6% = 53,129
" " 7% = 33,204
" " 8% = 19,134
" " 9% = 9,160
" " 10% = 2,084

[a] Outlays for single scholarship recipient minus total outlays for four scholarship recipients.

[b] Prior to adjustment for survival probabilities.

[c] After adjustment of retirement pay (years 25-85) for survival probabilities.

APPENDIX B

COMPARISON OF THE PRESENT AND PROPOSED MILITARY NONDISABILITY RETIREMENT SYSTEMS

I. PURPOSE

All calculations in the text of this study, both from the point of view of the individual physician and of the Navy, employed the assumption of the present military retirement system. However, the Department of Defense has proposed a new nondisability retirement system which could alter some of our conclusions, both about the attractiveness of military service to the physician and the return on Navy investments.[1] To have repeated each of our numerous calculations under the alternative assumption of the proposed retirement system would have unduly increased their number and the length of the report. Therefore, we have prepared this appendix to compare the financial implications of the proposed system with the present system.

DoD has stated that the underlying intent of the new retirement system is:

> ...to encourage more service members to strive for a 30-year career. Currently the services lose too many personnel at the peak of their professional development. A retirement system which provides new incentives to remain beyond 20 years will serve to reduce this loss of personnel with critical skills.[2]

Physicians are a prime example of a group with critical skills; this is a community in which retention has been low in the past, and for which the new retirement system presumably seeks to provide incentives to remain in the future. Therefore, our primary interest is the effect of the proposed changes on the attraction and retention of physicians. In particular, we have emphasized the effects on the scholarship recipient because the scholarship program is likely to become the major source of physician accessions in the future. However, we have also investigated the impact on physicians currently in the Navy and on fully-trained physicians who enter the Navy after the proposed changes become effective. The age, promotion, and income profiles used are those shown in appendix A.[3] We analyze the changes in the retirement system in isolation, that is, apart from any other factors which may reinforce or counteract these changes, such as the introduction of a bonus for physicians. Therefore, the amounts entered into physicians' income streams and discounted to present values are gross of taxes, whereas the present values of physicians' net income streams were calculated in the text.

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[1] "The Proposed New Military Nondisability Retirement System," Department of Defense, 1973.

[2] Ibid., p. 7.

[3] Tables A-1, A-12, and A-13.

Our results appear to be applicable to the officer community generally. Physicians' retirement benefits are predicated upon their base pay; such items as special pay, continuation pay, and prospective bonuses are not included in the retirement base. However, physicians will commonly have higher base pay than officers with the same active service because of higher entry grades, faster promotion, and constructive service credit for pay purposes.

II. PRINCIPAL FEATURES OF THE NEW SYSTEM

The principal features of the proposed new system as compared with the old which are relevant for the person about to enter the military service are:

(1) Under the old system, the service member may retire at the end of 20 years of service with a pension equal to 50 percent of the basic pay in the highest grade in which he served satisfactorily. Under the proposed system, the member retiring after 20 years of service would receive a pension equal to 35 percent of his final year's basic pay; this would be increased to 50 percent at the point at which the retiree would have reached 30 years of service.

(2) For service over 20 years, under the current system the pension increases to a maximum of 75 percent of basic pay for 30 years of service. Under the proposed system, the pension will increase to a maximum of 78 percent of basic pay for 30 years of service.

(3) Under the proposed system, upon reaching age 65 the member's retirement pay will be reduced by 50 percent of that portion of his Social Security benefit based on service-related earnings; under the present system, there is no such reduction.

(4) Under the present system, most physicians separating for reasons other than disability receive no pension if they have less than 20 years of service. Under the proposed system, a member with at least 10 and less than 20 years of service will receive from 25 to 45 percent of basic pay, depending on length of service, as a deferred annuity beginning at age 60.

III. EFFECT ON ATTRACTION INTO THE SCHOLARSHIP PROGRAM

First we consider the prospective physician at age 22, contemplating acceptance of the DoD scholarship and a 20-year active duty career. Retirement payments under either system will begin 25 years in the future, at age 46, and continue for the rest of his life.[4] He retires as a Captain (0-6) with 22 years of service creditable for pay purposes. The 1973 base pay for this grade is $22,824 per year. The stream of retirement payments based on 1973 pay under both the present and proposed retirement systems are shown in table B-1. However, this base pay will have increased by the time the individual entering the scholarship program in 1973 retires 24 years from now, as will the pension based upon it. Therefore, we have adjusted the final year's base pay by compounding the 1973 pay at 2 percent per annum in real terms (i.e., dollars of constant purchasing power) as discussed in Appendix A, and recalculated the streams of retirement income under both systems. These adjusted streams are also shown in table B-1, and serve as the basis for the calculations in this appendix.[5]

The physician's annual benefits will be $5506 lower under the proposed system during the first 10 years of retirement, identical during the next 9 years, and $1944 lower during the remaining years. The benefits are lower during the final years (from age 65) under

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[4] The retirement stream has been adjusted for survival probabilities in the manner explained in Appendix A, using the survival rates shown in table A-8.

[5] This Appendix differs in two important respects from an earlier paper we prepared on the same subject. (E. J. Devine, "The Financial Consequences for Physicians of the Proposed New Military Nondisability Retirement System," (CNA)778-73, Center for Naval Analyses, Arlington, Va., 25 April 1973.) In that paper, we assumed that an individual of a given age received retirement payments for the number of years of expected life at that age, rather than adjusting retirement payments by survival probabilities. We also predicated retirement pay on the 1973 base pay instead of adjusting for real growth in the base pay as we have done here. These changes do not reverse any of the conclusions of the earlier paper; in many cases they strengthen them.

TABLE B-1

STREAM OF ANNUAL RETIREMENT BENEFITS UNDER TWO SYSTEMS

Future years	Age	Current system		Proposed system	
		Based on 1973 pay	1973 Pay compounded[a]	Based on 1973 pay	1973 Pay compounded[a]
25 through 34	46-55	$11,412	$18,355	$ 7,988	$12,849
35 through 43	56-44	11,412	18,355	11,412	18,355
Remainder of life	65-	11,412	18,355	9,463	16,411

[a] At 2 percent per annum for 24 years.

the proposed system because of the Social Security offset. However, the physician will not be receiving higher Social Security benefits; he would receive the maximum Social Security benefit under either retirement system.[6]

Table B-2 shows the present values of these two streams and the differences between them at discount rates of 0 (i.e., the undiscounted sum), 5, 6, 7, and 10 percent.

It may be seen that the difference in the two streams of retirement payments is about $75,000 between the undiscounted sums and $3400 between the present values discounted at 10 percent. To help put this in perspective, the former difference is less than 5 percent of the undiscounted after-tax lifetime earnings of about $1,552,370 which would be received by a scholarship recipient who completed a 20-year Navy career under present pay scales; the latter difference is about 2 percent of the present value of these earnings discounted at 10 percent. As we have suggested elsewhere in this report, a discount rate of 10 percent does not seem unduly high for a 22-year old. For all present values calculated, the differences between the two streams are not great. Moreover, neither retirement system will affect the decision of the medical student who plans to finance his education with a DoD scholarship and leave the Navy as soon as his obligated service has been completed. Therefore, we conclude that the effect of the proposed new retirement system upon attraction of students into the scholarship program will be negligible.[7]

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[6] Calculation of the amount of the Social Security offset according to the method used by DoD is rather complex, and we used a less precise but simpler method for our estimates. DoD has prepared a table listing percentages which may be applied to the final year's base pay in order to estimate the offset. (Op. cit., p. 19.) However, we have been informed that these percentages were derived under the assumptions of a 4 percent annual increase in base pay and a 1-1/2 percent annual increase in Social Security benefits and in the amount of earnings subject to Social Security taxes. They do not have general applicability. Their projections were made in nominal terms, i.e., no adjustment was made for inflation. We have not projected growth in these benefits in our study, and we used the maximum primary benefit of $4860 in 1973 dollars. The offset can never be as high as 50 percent of the primary Social Security benefit. We have estimated the Social Security offset at 40 percent of the current maximum benefit ($1944) for a 20-year Navy career and 20 percent ($972) for a 10-year Navy career. We have determined that substituting this simple estimation procedure will have a negligible effect on our results.

[7] Similar calculations (not shown here) for the civilian physician contemplating a Navy career upon completion of residency also lead to the conclusion that the effect of the proposed change in the retirement system on attraction into the military is negligible.

TABLE B-2

PRESENT VALUES OF RETIREMENT PAYMENTS
UNDER TWO RETIREMENT SYSTEMS
(DISCOUNTED TO TIME OF ENTRY INTO MEDICAL SCHOOL)

Discount rate (percent)	0	5	6	7	10
Present system	$528,839	$79,780	$56,788	$40,845	$16,041
Proposed system	454,272	65,543	46,229	32,953	12,619
Difference	74,567	14,237	10,559	7,892	3,422

IV. EFFECT ON RETENTION AFTER 10 YEARS OF SERVICE

Next, we shall consider the possible effect of the new retirement system on the scholarship recipient (who entered service after the passage of the new retirement legislation) when he has completed 10 years of active duty, which occurs two years after the end of his obligated service. The two streams are as shown in table B-1, however the first payment is now to be received 11 years in the future, and the column showing future years should be adjusted, pari passu. (The age column remains correct.) Table B-3 shows the present values of the two streams and their differences from this new vantage point in time, with the undiscounted sums, of course, remaining the same as in table B-2.

TABLE B-3

PRESENT VALUES OF RETIREMENT PAYMENTS UNDER TWO RETIREMENT SYSTEMS (DISCOUNTED TO TIME OF COMPLETION OF 10 YEARS ACTIVE DUTY; ENTERED UNDER NEW SYSTEM)

Discount rate (percent)	0	5	6	7	10
Present system	$528,839	$157,958	$128,393	$105,320	$60,916
Proposed system	454,272	129,771	104,520	84,971	47,919
Difference	74,567	28,187	23,873	20,349	12,997

By this point in time the present values of the two streams and the differences between them have become rather substantial, even at a discount rate of 10 percent, ranging between 2 to 6-1/2 times as great as they did when viewed at the outset of the career (table B-2). It may still be argued that the differences are rather small in view of the magnitudes involved in the earnings stream for the remainder of the physician's lifetime. These differences are 4 to 5 percent of the remaining after-tax income stream if he completes a 20-year Navy career under current pay scales. But this is not all; if the physician chooses to leave after 10 years of active duty, under the proposed system

he will receive a deferred annuity beginning at age 60 amounting to 25 percent of his base pay, which at this point would be $20,607.[8]

The physician has just reached age 36 and the deferred annuity will commence 25 years in the future and continue for life. This deferred annuity will consist of annual payments of $5151 during the five years 25-29 years hence, and $4179 during all subsequent years, the decrease again being a result of the Social Security offset. The undiscounted sum of this stream is $73,974, and the present values at various discount rates are as shown in table B-4.

TABLE B-4

PRESENT VALUES OF DEFERRED ANNUITY UNDER PROPOSED LEGISLATION
(IF PHYSICIAN LEAVES NAVY AFTER 10 YEARS ACTIVE DUTY;
FIRST PAYMENT 25 YEARS HENCE)

Discount rate	Present value
0 percent	$73,974
5	13,899
6	10,198
7	7,535
10	3,156

The present value of the deferred annuity is modest at a 10 percent discount rate, but much more substantial at 5 percent. We may conjecture that whatever the physician's discount rate was at age 22, it is likely to be lower at age 35.

Consider now the net effect of both provisions of the proposed system for the physician with 10 years of active duty (who entered service after the introduction of the new system), that is, the effect of both the reduction in the pension he will get if he remains and the deferred annuity he can get if he leaves. These are shown in table B-5.

[8] He would be an 0-5 with 12 years for pay purposes. The current base pay for this rank and service credit is $15,617. But the student entering the scholarship program today will reach this point 14 years hence; $15,617 compounded at 2 percent annually for 14 years is $20,607.

TABLE B-5

NET EFFECT OF PROPOSED AS COMPARED WITH PRESENT RETIREMENT SYSTEM
(SCHOLARSHIP RECIPIENT WITH 10 YEARS ACTIVE DUTY;
ENTERED UNDER NEW SYSTEM)

Discount rate (percent)	0	5	6	7	10
Decreased value of new pension compared with old	74,567	28,187	23,873	20,349	12,997
Value of deferred annuity under new system	73,974	13,899	10,198	7,535	3,156
Total difference to physician	148,541	42,086	34,071	27,884	16,153

We shall illustrate the interpretation of table B-5 using the first column, i.e., the undiscounted sums. Under the new retirement system, he will receive $74,567 less if he remains for another 10 years than he would have under the old system; on the other hand, if he leaves now, he will receive $73,973 more under the new system. (He would have received zero under the old system.) Therefore, the total difference is $148,541. In other words, under the new system he loses a pension of $454,272 (undiscounted), less a deferred annuity of $73,974 for a net loss of $380,298 if he leaves at this point. Under the old system, he would have lost $528,839 by leaving. Therefore, the "cost of leaving" has decreased by precisely $148,541 ($528,389 less $380,298).

If the differences are discounted at various rates, then the decrease in the cost of leaving ranges from $42,086 at 5 percent to $16,153 at 10 percent. Such differences do not appear to be negligible. In interpreting them, however, it must be remembered that this paper focuses solely upon the change in retirement systems. For the physician community, the increased incentive to leave after 10 years may be countered by the judicious employment of a bonus if the bonus legislation is enacted. For others, it could be offset by improvements in other components of pay during the remaining years of service.

The effect of the new system will not be as great for the physician who has 10 years of active service at the time the proposed retirement legislation is enacted, although it still appears that the incentive to remain will be significantly attenuated. This physician will become eligible for the deferred annuity immediately upon passage of the legislation.

However, the transition feature of the proposed system provides that during the first 10 years of retirement (after 20 years active duty) he will receive 42.5 percent of his base pay, rather than the 35 percent applicable to the member entering after the new system is in effect. Let us assume that at the 10-year point this physician is also 35 years old and an 0-5 with 12 years for pay purposes. In that case, his benefit during the first 10 years after retirement will be $11,825.[9] During the next nine years, retirement pay will be 50 percent of base pay in the final year, or $13,912. During all subsequent years, the payment will be reduced to $11,968 because of the Social Security offset. The present values of the retirement streams under the two systems and of the differences are shown in table B-6.

TABLE B-6

PRESENT VALUES OF RETIREMENT PAYMENTS
UNDER TWO RETIREMENT SYSTEMS
(DISCOUNTED TO TIME OF COMPLETION OF 10 YEARS ACTIVE DUTY;
10 YEARS COMPLETED AT TIME OF ADOPTION OF NEW SYSTEM)

Discount rate (percent)	0	5	6	7	10
Present system	$400,829	$119,723	$97,314	$79,826	$46,171
Proposed system	358,449	106,833	86,710	71,010	40,836
Difference	42,380	12,890	10,604	8,816	5,335

These differences are less than half the size of the losses of the man who enters service after the new system is in effect and completes 10 years (see table B-3), but they too must be combined with the deferred annuity to estimate the total decrease in the "cost of leaving." If we add the above differences to the amounts shown in table B-4, we get the following totals: at 0 percent, $116,174; at 5 percent, $26,789; at 6 percent, $20,802; at 7 percent, $16,351; and at 10 percent, $8491. These total effects range from 53 percent to 78 percent of those shown in table B-5, and particularly at the lower discount rates it would appear that the incentive to remain for a 20-year career may be considerably reduced for many physicians in this category.

[9]The current pay of an 0-6 (over 22) is $22,824. But retirement is still 10 years in the future, and this amount compounded annually over 10 years at 2 percent is $27,823, 42-1/2 percent of which is $11,825.

V. EFFECT ON RETENTION AFTER 20 YEARS OF SERVICE

Finally, we shall address the effect of the proposed retirement system on retention at the 20-year point. For the physician who has 20 years of service at the time the new system goes into effect, there will be no change in his pension benefits if he retires at that time because of the transition provision. The new provisions for retirement at age 30 will provide negligible additional incentive to remain. If he completed 30 years of service at age 55, he would receive an additional annual benefit of $772 during the first nine years of retirement (compared with retirement after 30 years under the old system), and an additional annual benefit of $350 per year thereafter.[10]

For the physician who enters the scholarship program after the new system is in effect and completes 20 years, the additional benefits at the 30-year point (i.e., 78 percent of base pay rather than 75 percent) likewise provide little additional incentive to remain. However, as compared with the present system, he would lose a fairly substantial sum during the first 10 years of retirement if he retired after 20 years. Once again, table B-1 shows the stream of benefits under the two systems, but now year 25 becomes year 1, etc., and the present values are substantially higher than they were when viewed from the vantage points of entry into medical school or completion of 10 years of active duty. These present values are shown in table B-7.

TABLE B-7

PRESENT VALUES OF RETIREMENT PAYMENTS
UNDER TWO RETIREMENT SYSTEMS
(DISCOUNTED TO TIME OF COMPLETION OF 20 YEARS
ACTIVE DUTY: ENTERED UNDER NEW SYSTEM)

Discount rate (percent)	0	5	6	7	10
Present system	$545,167	$265,241	$237,031	$213,576	$162,878
Proposed system	468,298	217,910	192,959	172,311	128,127
Difference	76,869	47,331	44,072	41,265	34,751

[10] The Social Security offset would be small in this case because of transition provisions.

At a 5 percent discount rate, which appears reasonable for a man of this age, it will cost him $47,000 if he leaves under the new system as compared with the old, and even at a 10 percent discount rate, the cost will be almost $35,000. Therefore, if the physician completes 20 years of service, the new system does give him a stronger incentive to stay for 30 years than did the old, or perhaps more accurately, it penalizes him much more heavily if he leaves after 20 years.

VI. CONCLUSIONS

The reader is again reminded that the conclusions pertain to the effects of the proposed retirement system as compared with the present system considered in isolation, that is, apart from any other changes which may simultaneously be adopted. With respect to the physician who enters service after the adoption of the proposed system, our conclusions are:

1. The effect of the new system upon attraction of students into the DoD medical scholarship program will be negligible.

2. For the physician at the completion of 10 years of active duty, the "costs of leaving" have been reduced (the incentive to remain has been attenuated) considerably. That is, the adverse effects upon retention are potentially substantial.

3. For the physician at the completion of 20 years of active duty, the costs of retiring now rather than after 30 years of service have increased substantially.

With respect to physicians who have completed 10 or 20 years of active duty at the time the new retirement system is adopted:

4. The "costs of leaving" after ten years have been reduced by a lesser amount than for the physician who entered under the new system because of the transition provisions of the new retirement system; however, the reductions in these costs still appear large enough to be potentially significant.

5. There is virtually no change in the incentive to remain or leave for the physician who has 20 years service at the time the new system is adopted because of the transition provisions.

With respect to the stated DoD goals quoted at the beginning of this paper, namely, to encourage individuals with critical skills to remain for a 30-year career, it seems clear that the new retirement system will do just the opposite. It is true that the new system levies a heavy penalty for leaving after 20 years of service as compared with the old system, but it also substantially reduces the cost of leaving after 10 years or so. That is, compared with the present system, we would expect that more of these who do remain for 20 years will stay on for 30, but fewer will remain for 20 years in the first place. A comparison of the present values of the liability for deferred annuities at the 10-year point (table B-4) with the present values of the retirement pay liabilities at this point (tables B-5 and B-6) lead to the conclusion that the effect, if not the intent, of the proposed system is to induce fewer officers to remain for 20 years and thereby to reduce retirement costs.

APPENDIX C

THE POTENTIAL USE OF CIVILIAN PHYSICIANS BY THE NAVY

I. INTRODUCTION AND SUMMARY

The purpose of this appendix is to estimate the minimum number of Navy physician billets which could be civilianized while retaining a sufficient number of military physicians for those purposes commonly thought to require them, such as quick response to contingencies and the provision of medical support in combat areas. The potential for civilianization is estimated on a specialty-by-specialty basis. However, because a billet could be civilianized without detriment to military capabilities does not necessarily mean that it should be. This depends upon the relative costs of staffing with military and civilian physicians.

We illustrate this point by citing two specialties which could be entirely staffed with civilians according to the analysis in this appendix, without jeopardizing military capabilities. These are pediatrics and obstetrics-gynecology; moreover, because these entire specialties could be civilianized, it would no longer be necessary for the Navy to offer residency training in them. The median income for pediatricians in the civilian sector is well below the all-specialty median and the median income for obstetrics-gynecology is well above it. Therefore, it would probably pay to civilianize the former specialty but not the latter, even though there is no military need for obstetricians and gynecologists to be naval officers. It appears to be less costly to obtain these specialists as officers through the scholarship program than to hire civilians who are already trained. Income data for these specialties by years of practice would enable us to demonstrate whether this is or is not the case, using the same methods of analysis as we did in the text.

The method of analysis is to examine the assignment of Navy physicians by specialty in both a wartime year (1967) and a peacetime year (1972); staffing levels were about the same in each year. This analysis shows us which specialists are actually used in performing those missions thought to require military physicians, and to what extent. The provision of direct combat support, and hence the mobilization capability for such support, is shown to be concentrated among six specialties. A majority of specialties are utilized in much the same way in time of war or peace, and do not serve peculiarly military requirements.

By analyzing the actual utilization patterns on a specialty-by-specialty basis, we are able to estimate the extent to which physicians in each specialty could have been civilianized in 1972, when the staff level was 4570. We find that a minimum of 40 percent of both post-residents and total physicians could have been civilianized without jeopardizing military missions. This is in contrast to a service-wide estimate of 8 percent by DoD.

We next consider the case of a 3000-physician staffing level. We are unable to repeat the above procedure because we do not have data on what the composition of the smaller staff would be by specialty and assignment. Therefore, we instead ascertain whether the

40 percent estimate would be inappropriately high at the reduced staffing level. In particular, we examine whether this overall degree of civilianization would leave enough military physicians in the appropriate specialties to perform military missions. We find that it is not unreasonable. Of course, the degree of civilianization would vary among specialties, from zero percent to 100 percent. The total or predominant civilianization of several entire specialties would also eliminate the need for military residencies in those specialties. To the best of our knowledge, no comparable analyses exist; we have seen none which address the issue on a specialty-by-specialty basis, as we feel it must be.

It must be stressed that our estimate of the extent of civilianization is a conservative, or minimum, estimate. This is so because of the magnitude of the postulated contingency that the Navy would be prepared to meet, namely, one of the size of the Vietnam war at its peak. Under our procedure, there would be enough military physicians on board, in the appropriate specialties, not only to provide a mobilization base for a contingency of this magnitude, but actually to provide the direct combat support, and to do so immediately. Another reason why our estimate is conservative is that we have identified only those billets where the flexibility associated with military physicians is clearly of little value to the Navy.

The analysis in this appendix was based on one form of civilianization, namely, the direct employment of physicians by the Navy, although some alternative methods are discussed. The analysis in the text, however, is based upon hiring civilian contract physicians at the median income for self-employed civilian physicians of $44,000 per year. This requires an explanation. The appendix was written first, in order to estimate how many billets could be civilianized without jeopardizing military missions. We recognized, however, that there was little chance of filling these billets under present Civil Service pay policies. We could have compared the cost of military physicians with Civil Service physicians; this would have entailed estimating a promotion profile, the cost of fringe benefits, and retirement costs for civilians in the same manner as was done for military physicians. Such an analysis would probably show civilianization to be less expensive, however, since we doubt that an appreciable number of civilians could be attracted under the present system, this would have been a futile exercise as well as a very time-consuming one. We preferred to use civilian income figures which we were reasonably sure would enable the Navy to attract a large number of physicians, therefore, we used the median income for self-employed physicians.

We recommend in this paper that the Navy support a revised system of compensation for its civilian physicians. This system would more closely resemble the one recommended by the Job Evaluation and Pay Review Task Force than the present Civil Service system. In retrospect, it appears that a model of lifetime income under such a system should have been constructed and evaluated. A revised civilian compensation system may enable the Navy to obtain an appreciable number of civilian physicians at lower costs than the median incomes for self-employed physicians. This may reverse some of our conclusions about

the profitability of investing in the scholarship program compared with hiring civilians. However, the advisability of such a comparison was not so obvious to us until we completed our analysis, and time did not permit undertaking it subsequently.

II. WHY CIVILIANIZE?

We do not advocate the civilianization of physician billets for its own sake. Perhaps this question is best addressed by asking the opposite question: Why have physicians in uniform? What does the Navy gain by this?

The recent DoD-HEW joint report[1] lists "six military requirements (which) can only be met" by the use of military physicians. These are:

1. Maintaining mobilization expansion capacity. (This does not include the mobilization expansion force itself, but only the military physicians necessary to direct and control an expansion force in the event of mobilization.)

2. Directing and controlling the military health care system.

3. Providing direct combat support.

4. Staffing specialized research and development programs in such a way as to couple research results with operating needs.

5. Maintaining a rotation base in order to adequately staff sea duty and overseas requirements and fill unpopular assignments within the United States.

6. Maintaining a base for graduate education programs, both as a source of future career officers, and for professional career development.

None of these requirements can "only" be met by military physicians, but it may be that some of them can best be met in this way. With this qualification, we accept "requirements" 1 through 4. It may be seen upon reflection that the 6th requirement stated is not a reason why certain billets can only be filled by military physicians; rather, it is something that it may pay DoD to do.

The 5th requirement listed is maintaining a rotation base; we have addressed this issue elsewhere.[2] In that paper, we pointed out that maintaining a rotation base is but one approach, and probably an inferior one, to dealing with the existence of unpopular assignments. There are some billets, such as sea duty, which are probably best filled

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[1] "Reducing the Needs for Military Medical Personnel in the Armed Forces," a Report to the President and Congress by the Secretary of Defense and the Secretary of Health, Education, and Welfare, October 1972. (Hereafter cited as DoD-HEW Report.)

[2] Eugene J. Devine and Brian E. Forst, Navy Physician Staffing Levels, CNA Study 1023, Center for Naval Analyses, Arlington, Va., October 1973.

by military physicians, and the military pay system will probably constrain us to dealing with them by maintaining a rotation base. We did show that, for the Navy, rotation is a problem primarily for general medical officers.

It is not clear that overseas assignments and unpopular assignments in the United States can only be filled by military physicians. On the contrary, civilianization could present a better solution to the problem of undesirable billets than the alternative of maintaining a rotation base. BuMed has recognized this, and it is precisely these billets which it would like to civilianize.[3] This could be done with a properly structured compensation system for civilian physicians, which we discuss later in this appendix.[4] With these serious qualifications, there is some justification for having military physicians to provide a rotation base. But the existence of overseas and unpopular U.S. assignments point in the opposite direction.

Requirements 1 and 3 provide the most important reasons, at least in a quantitative sense, for having physicians in uniform; that is, the Navy Medical Department must be prepared to mobilize physicians quickly and to send them into combat situations when they arise. This is not to say that maintaining a number of military physicians on active duty is the only way to obtain mobilization capability. There are at least three alternative ways, viz.:

1. Pay civilian physicians a retainer to join the reserve, subject to immediate call-up if a contingency arises;

2. Draft physicians when a contingency arises, either by maintaining standby authority or passing legislation at the time;

3. Simply pay whatever it takes to get physicians to serve at the time the contingency arises.

It should be noted that physicians providing combat support could be civilians. There is a price at which physicians will voluntarily serve in combat areas. Construction companies have induced many civilians to serve in Vietnam.[5]

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[3] CHBUMED Memo for CNO, BUMED-15-nmh, 20 September 1972, Subject: Reduction in Strength of Health Professions, p. V-6.

[4] The problem could also be solved by the appropriate restructuring of the compensation of military physicians, but we regard this as even less likely to come about.

[5] It should be noted that "serving in a combat area" does not necessarily imply high risk of life. The total number of Navy officers killed in Vietnam from 1961 through 1971 was 212. (Navy Times, May 31, 1972, p. 6.)

We shall not perform an analysis of these alternative means of providing mobilization capability here. The three alternatives mentioned would probably all require more time, and it is not apparent whether any of them would be more or less cost-effective. Moreover, given the fact that the Navy provides medical care for a substantial number of civilian beneficiaries, the choice of active duty physicians does not mean that they will be idle or underemployed, merely providing response capability in the event a contingency arises.

What the Navy gains by having a physician in uniform, therefore, is a quick response capability. It buys flexibility in the disposition of his services; it can order the physician, on short notice, to any place in the world and into combat situations. The reason for this flexibility is that the military is unique among employers in that it has the capability of entering into an apparently enforceable contract with a physician (or anyone else), under which non-performance is punishable by incarceration. Specific performance cannot be compelled of a person not subject to the Uniform Code of Military Justice by such a threat.

However, this same flexibility which is an advantage to the Navy is likely to be perceived as a distinct disadvantage by physicians, and one to which they are not subject in the civilian sector. Numerous surveys of military physicians have shown instability to be a major nonpecuniary source of dissatisfaction. The Surgeon General is aware of this and has adopted policies to minimize the instability, but it will always be greater than in civilian life. There are other nonpecuniary sources of dissatisfaction peculiar to the military which can be mitigated to a certain extent, but not completely eliminated. [6]

As our analysis shows, there are many billets, including several entire specialties, where the value of this flexibility appears to be slight. Even so, if these billets can be filled at lower cost by military physicians (for example, through the scholarship program), then this should be done. It appears that this may be the case for obstetrics-gynecology. Where these billets cannot be filled at lower cost with military physicians, there is no reason to pay a premium for flexibility which is of little value. This may be the case for pediatricians. It appears unlikely that all billets could be filled at lower cost by military physicians, and it is worthwhile to identify in advance those billets for which the flexibility gained by having a military physician is not worth paying a premium. It is fortunate in this regard that military appropriations legislation (P. L. 92-570) makes it easier for DoD to transfer funds from military pay appropriations to civilian pay appropriations.

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[6] For a list, see the DoD-HEW report, op. cit., p. 38.

III. PREVIOUS ESTIMATES OF CIVILIANIZATION

We are not aware of any previous estimates of the number of physician billets which could be civilianized for the Navy alone, but there are two estimates for the entire Department of Defense. In the DoD-HEW report, DoD recommends the following physician staffing level and structure: total physicians, 11,300; civilians, 935 (8 percent), military, 10,362; the military physicians would consist of 8000 post-residents and 2362 interns and residents. DoD stated that the armed forces need a minimum of 8000 post-resident physicians on active duty at all times. However, no basis for this estimate is presented, and apparently no demonstrable basis exists. There is also no explicit discussion of why civilianization might be desirable. HEW noted that it lacks any valid basis for judgment and has not developed an independent estimate of DoD requirements for physicians in military status.[7]

Lando asserted that at least two-thirds of the billets in a total DoD medical corps of 12,000 could be civilianized, also without any apparent basis.[8] The Gates Commission report was more cautious; it recommended "a careful analysis...to determine the minimum number of doctors required on active duty...based on realistic contingency plans and on rotation base requirements for planned force levels."[9]

On the other hand, the DoD-HEW report states that because one physician might serve a number of purposes, they do not believe it is feasible or meaningful to specify the precise number of military physicians for any single requirement, such as rotation or mobilization.[10] We strongly disagree; we believe that even the relatively crude analyses of mobilization and rotation presented here and in CNA Study 1023 are a significant improvement (and result in markedly different conclusions) upon the listing of several "requirements" and somehow attaching a number to them. Indeed, it is noteworthy that the DoD-HEW report does not even specify the nature or extent of the contingency for which the medical corps must have a mobilization capability.

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[7] Op. cit., pp. 4, 71.

[8] Mordechai Lando, "Health Studies in the All-Volunteer Armed Force," Studies Prepared for the President's Commission on an All-Volunteer Armed Force, Vol. II, Washington, D.C., November 1970. Under Lando's proposal, there would be no allowance for active duty physicians to meet crises. He would rely on a reserve medical corps for this, supplemented by stand-by draft authority for wartime.

[9] The Report of the President's Commission on An All-Volunteer Armed Force, Washington, D.C., February 1970, p. 92.

[10] Op. cit., p. 71.

IV. METHOD OF ANALYSIS

The procedure is to examine the assignment of Navy physicians by specialty in both peacetime and wartime. Specifically, we have compared physician utilization in September 1967 and in February 1972. Total Medical Corps strength was about the same in each month, 4647 in 1967 and 4570 in 1972. Our purpose is to see how many physicians, and in which specialties, were assigned in or near the combat area during a period of heavy combat in Vietnam.

We have taken as given the requirements for military physicians set forth in the DoD-HEW report, as discussed above, and subject to the qualifications stated there. Thus, we have considered that all administrative and research billets are to be filled by military physicians. In the absence of any guidance as to the magnitude of the contingencies which the Medical Corps should be prepared to meet, we have postulated a combat situation of the magnitude of Vietnam in 1967. We have assumed that the Medical Corps should have sufficient military physicians on board not only to provide a mobilization base for such a contingency, but actually to provide for direct combat support at this level immediately.

We then identify the specialties which were heavily used in the combat area in 1967, and which therefore would be heavily affected by mobilization. The numbers and proportions of post-residents used in providing direct combat support in each specialty are estimated. We also see which specialists are used exclusively or predominantly in hospitals and dispensaries, even in time of war. In this way, we arrive at an estimate of the numbers and proportions in each specialty which are not, in fact, used to fulfill any of the stated military requirements, and which could therefore be civilianized. We then extend this to the entire Medical Corps; in those specialties which can be almost completely civilianized, there is no military requirement to offer residency programs. The result is an estimate of both the post-resident physicians and all physicians of the 4570 on board in February 1972 who could have been civilianized if they were to be assigned in the same way as they were then. Our estimate is that a minimum of 40 percent of both post-residents and all physicians could have been civilianized.

We then address the same questions with respect to a 3000-physician Medical Corps. It was not possible to repeat the same procedure because of the absence of data showing the composition of a 3000-man staff by specialty and type of assignment. Therefore, we sought to discover whether the 40 percent civilianization estimate resulting from the analysis of the 4570 staffing level was reasonable for the 3000 level. Clearly, those physicians who do not serve to fulfill any of the stated military requirements even in wartime could be civilianized at any staffing level. Therefore, we concentrated our attention on those six specialties which are heavily used to provide combat support, in order to find out whether civilianization of 40 percent of post-resident and total billets would leave enough military physicians in these specialties for mobilization and combat support.

It should be stressed that the estimated degree of civilianization is conservative for three reasons. (1) We have assumed that enough military physicians should be on board at all times to meet a contingency of the size of Vietnam, and to do so immediately. That is, there would be enough on board to actually provide the combat support immediately, not just to serve as a base for mobilization. (2) We have estimated the percentage of billets which could have been civilianized at the 4570 level of February 1972 if physicians were assigned in the same way as then. However, we know that they will not be assigned in the same way, whatever the ultimate force level. It appears that specifically military types of assignments will be reduced in greater proportion than other types. For example, physicians are being removed from ballistic missile submarines; these are all included as military billets in our civilianization estimates for February 1972. (3) For the most part, we have accepted the "requirements" for military physicians as stated by DoD-HEW; for example, that all physician research billets should be filled by military physicians.

V. THE ANALYSIS

A. The Data

The basic data for the analysis, presented in tables 1 through 5, have been furnished by BuMed in slightly different form. Although incomplete in several respects, to be discussed presently, the data are usable for our major purpose, viz., to identify those specialties employed in or near combat areas in time of war. These are the specialties for which rapid mobilization and deployment capability are important in meeting contingencies.

Table C-1 shows type of assignment by specialty for 4104 of the 4570 physicians on board in February 1972. For the remaining 466 physicians, the type of assignment, but not the specialty, was furnished. These are listed in the last seven columns of table C-1. Those assigned to other mobile operating units, marine construction battalions, and AFEES probably are predominantly general medical officers, but the other assignments undoubtedly consist of a wide variety of specialties.

Likewise, in table C-2 the specialty breakdown furnished accounted for only 3941 of the 4647 physicians on board in September 1967.[11] The other 766 physicians presumably were in the same types of assignments (AFEES, administration, etc.) for which identification by specialty was not available in 1972.

B. Specialties Employed in Viet Nam

The original BuMed data listed specialties assigned to specific hospitals. Unfortunately, the Station Hospital at DaNang was not separately identified, nor are physicians aboard the two hospital ships and in other Viet Nam assignments readily identifiable from table C-2. However, a comparison of tables C-1 and C-2, together with some additional information contained in an article by Cdr. F. O. McClendon, Jr., of the Medical Service Corps[12] provides a good indication of those specialties used in providing direct combat support and the extent to which they were used.

According to McClendon, about 400 physicians were assigned to the combat area in 1969, both ashore and afloat. Information in the article enables us to account for about

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[11] "Navy and Marine Corps Military Personnel Statistics," Department of the Navy, 30 June 1968.

[12] "Doctors, Dentists, Nurses and Corpsmen in Viet Nam," United States Naval Institute Proceedings, Vol. 96, May 1970.

TABLE C-1

U.S. NAVY MEDICAL OFFICERS ON BOARD, FEBRUARY 1972, BY SPECIALTY AND ASSIGNMENT

Specialty number	Specialty title	Hospitals	Number of hospitals	Residents	Interns	BuMed dispensaries	Regional medical center	Other dispensaries	Air squadrons	Ships	FMF	Other mobile operating units	MCB	AFEES	Staff and administration	Research	Education and training	TPP	Total
00	General medical officer	474	(38)	11	154	34	67	411	2	172	99								1424
05	Aviation medicine (flight surgeon)	24	(12)				5	92	120	15	42								298
06	Aviation medicine (aviator)	1	(1)					4	5	2									12
08	Submarine medicine	5	(5)			1		20		52									78
11	Public health							3		1									4
13	Occupation medicine						1	1		1									3
17	Tropical medicine	1	(1)					1											2
19	Nuclear medicine	1	(1)																1
20	Internal medicine	178	(37)	84		3	2	7		1									275
21	Gastroenterology	12	(8)	5															17
22	Allergy	4	(4)																4
23	Hematology	7	(5)	5															12
26	Pulmonary disease	4	(3)	3															7
28	Cardiovascular disease	26	(14)	4		1		1											32
30	Radiology	102	(34)	37		3	2	6			1								151
37	Radiobiology	2	(2)					1											3
40	Pathology (anatomical)	66	(26)	27			1	3											97
45	Physiology									1									1
50	Psychiatry	127	(32)	19		6	2	38			5								197
56	Neurology	32	(16)	1															33
60	General surgery	162	(38)	68			1	13		13									257
62	Plastic surgery	19	(10)	2															21
64	Thoracic surgery	26	(15)	5		1													32
65	Neurosurgery	25	(14)	1															26
67	Proctology	1	(1)																1
70	Otolaryngology	47	(22)	35				1											83
77	Ophthalmology	59	(27)	27		1	3	3											93
82	Research	1	(1)					2											3
84	Pediatrics	150	(38)	36		6	2	19											213
85	Physical medicine	2	(2)																2
89	Dermatology	46	(23)	18		1	1	1			1								67
91	Orthopedic surgery	116	(33)	58				2											177
93	Anesthesiology	148	(35)	40				5		1									194
96	OB GYN	137	(36)	51		3	2	19			2								214
97	Urology	44	(23)	24				1											69
99	Osteopathy							1											1
	No specialty information given											16	12	15	177	82	158	6	466
	Total	2049		561	154	60	89	655	127	259	150	16	12	15	177	82	158	6	4570

TABLE C-2

U.S. NAVY MEDICAL OFFICERS ON BOARD, SEPTEMBER 1967 BY SPECIALTY AND ASSIGNMENT

Specialty number	Specialty title	Hospitals	Number of hospitals	Residents	Interns	BuMed dispensaries	Other dispensaries	Air squadron	Ships	FMF	Other assignments	Total
00	General medical officer	202	(26)	10	186	37	332		204	188		1159
05	Aviation medicine (flight surgeon)			1		3	166	128	19	74		391
06	Aviation medicine (aviator)						5	2	1	1		9
08	Submarine medicine	5	(4)				20		60	1		86
09	Submarine medicine—nuclear						3		3			6
11	Public health						4		2			6
13	Occupational medicine						4		1			5
15	Epidemiology			1					1			2
19	Nuclear medicine						1					1
20	Internal medicine	219	(26)	79		10	68		19	23		418
21	Gastroenterology	2	(2)	1								3
23	Hematology	5	(5)									5
26	Pulmonary disease	3	(3)	2								5
28	Cardiovascular disease	7	(5)	2		1	1					11
30	Radiology	76	(26)	32		2	7			1		118
37	Radiobiology						1					1
40	Pathology (anatomical)	51	(23)	22			2		3	1		79
42	Pathology (clinical)	1	(1)									1
45	Physiology						2					2
50	Psychiatry	108	(23)	24		5	39			6		182
56	Neurology	26	(14)			1	3		1			31
60	General surgery	176	(26)	73		4	39		53	31		376
62	Plastic surgery	13	(8)	2								15
64	Thoracic surgery	14	(6)	6						1		21
65	Neurosurgery	31	(11)									31
67	Proctology	1	(1)									1
70	Otolaryngology	35	(21)	30		1	2		1			69
77	Ophthalmology	61	(25)	25		3	3			1		93
82	Research						1					1
84	Pediatrics	99	(26)	30		7	29			2		167
85	Physical medicine	5	(5)						1			6
89	Dermatology	44	(25)	13		2	1		1	1		62
91	Orthopedic surgery	90	(26)	34			5		1	19		149
93	Anesthesiology	73	(26)	35						13		121
96	OB-GYN	132	(26)	43		6	49		2	3		235
97	Urology	45	(22)	20								65
99	Osteopathy					2	6					8
	Specialty and assignment not given										706[a]	706
	Total	1524		485	186	84	793	130	373	366	706	4647

[a]Total 4647 (page C-10) less 3941 (as shown) = 706.

300 of these assignments as follows: 48 at the hospital at Da Nang, 50 on board the two hospital ships, and 200 with the First and Third Marine Divisions, the First Marine Air Wing, and combat support units. McClendon does not provide information on the specialties involved. However, by comparing the assignments to ships, air squadrons, and FMF units in 1967 and 1972 (tables C-1 and C-2), it may be seen that 216 more physicians were assigned to FMF units and 114 more to ships in 1967 than in 1972. The ship assignments presumably include the hospital ships, which were not active in 1972. If we add the 48 physicians at Da Nang to these numbers, we account for almost 400 physicians, and we do have a specialty distribution for those on ships and with the FMF. (The number of physicians assigned to air squadrons was about the same in each year.) Comparison of tables C-1 and C-2 shows that the additional physicians assigned to ships and FMF during 1967 were primarily drawn from the following six specialties: general medical officers, flight surgeons (assigned to FMF units), general surgeons, internists, anesthesiologists, and orthopedic surgeons. These, then, were the principal specialties involved in providing support in or near the combat area, and which would be affected by rapid deployment to such an area. Of the other specialties, there were generally only one or two more physicians assigned to ships and FMF units in 1967 than in 1972.

C. Estimate of Billets which Could be Civilianized at 4570 Staffing Levels

The data are reorganized into three groups of physicians in tables C-3, C-4, and C-5. The specialties listed in table C-3 were employed exclusively in hospitals in February 1972, those in table C-4 were employed primarily in hospitals in 1972, with most of the remaining assignments in dispensaries, and those in table C-5 had a significant portion of assignments to air squadrons, ships and FMF units in 1972. Each table shows the complete assignments for 1972 (exclusive of administrative and other assignments where specialty breakdown was not available) and the assignments to air squadrons, ships, and FMF units only in 1967.

Table C-3 shows that there were 10 specialties containing 124 physicians (including 17 residents) assigned exclusively to hospitals in February 1972. Many of these specialties are concentrated in only a few of the hospitals; for example, columns 1 through 3 of table C-1 show that 21 plastic surgeons were assigned to 10 of the 38 hospitals. Table C-3 also shows that only two of the 107 post-residents in these 10 specialties were assigned to ships in 1967, and none to FMF units or air squadrons. Some of these specialists may have been assigned to the Da Nang hospital in 1967, but the numbers could not have been large. These specialties are practiced almost exclusively in hospitals in times of both war and peace, and therefore there is no apparent need for rapid deployment to a combat zone, and hence for the flexibility gained by having these specialties filled by military physicians. An allowance of about 10 percent of the total number of post-residents in these 10 specialties would appear sufficient to staff the few combat-related assignments which may arise. Therefore, of this group we estimate that 97 of the post-residents could be civilians, with only 10 serving as military physicians.

TABLE C-3

SPECIALTIES UTILIZED EXCLUSIVELY IN HOSPITALS IN FEBRUARY 1972 AND NUMBERS ASSIGNED TO SHIPS, AIR SQUADRONS AND FMF IN SEPTEMBER 1967

		1972			1967
Spec. no.	Specialty title	Total	Post-residents	Residents	Ships
19	Nuclear Medicine	1	1		
21	Gastroenterology	17	12	5	
22	Allergy	4	4		
23	Hematology	12	7	5	
26	Pulmonary Disease	7	4	3	
56	Neurology	33	32	1	1
62	Plastic Surgery	21	19	2	
65	Neurosurgery	26	25	1	
67	Proctology	1	1		
85	Physical Medicine	2	2		1
	1972 Totals	124	107	17	

Table C-4 lists 18 specialties consisting of 1903 physicians (1438 post-residents and 465 residents) who were assigned primarily to hospitals in February 1972 and almost exclusively to hospitals and dispensaries combined. There were only 11 physicians assigned to ships and the FMF from these specialties in 1972. In only three of these specialties were a significant number of physicians assigned to ships and FMF units in 1967; these were internal medicine, anesthesiology, and orthopedic surgery. The other 15 specialties, with 974 post-residents in 1972, had eight physicians assigned to ships and the FMF in 1972 and 23 in 1967. There were 287 post-resident gynecologists, obstetricians and pediatricians in 1972, and there appears to be no reason why all of these specialists could not be civilians. There were 687 post-residents in the remaining 13 specialties, and a 10 percent military component would provide ample coverage for the relatively few combat-related assignments which may arise. Thus, for these 15 specialties, at least 904 post-residents could be civilians, with the remaining 70 being military officers.

TABLE C-4

SPECIALTIES UTILIZED PRIMARILY IN HOSPITALS IN FEBRUARY 1972 AND NUMBERS ASSIGNED TO SHIPS, AIR SQUADRONS AND FMF IN SEPTEMBER 1972

Specialty number	Specialty title	1972						1967	
		Total	Hospitals		Regional medical center and dispensaries	Ships	FMF	Ships	FMF
			Post-residents	Residents					
17	Tropical medicine	2	1		1				
20	Internal medicine	275	178	84	12	1		19	23
28	Cardiovascular disease	32	26	4	2				
30	Radiology	151	102	37	11		1		1
37	Radiobiology	3	2		1				
40	Pathology	97	66	27	4			3	1
50	Psychiatry	197	127	19	46		5		6
64	Thoracic surgery	32	26	5	1				1
70	Otolaryngology	83	47	35	1			1	
77	Ophthalmology	93	59	27	7				1
82	Research	3	1		2				
84	Pediatrics	213	150	36	27				2
89	Dermatology	67	46	18	3			1	1
91	Orthopedic surgery	177	116	58	2		1	1	19
93	Anesthesiology	194	148	40	5	1			13
96	OB-GYN	214	137	51	24		2	2	3
97	Urology	69	44	24	1				
99	Osteopathy	1			1				
	1972 Totals	1903	1276	465	151	2	9		

The remaining three specialties had the following numbers assigned to ships and/or the FMF in September 1967: internal medicine, 42; orthopedic surgery, 20; anesthesiology, 13. In addition, there were probably several of these specialists among the 50 physicians stationed at Da Nang. If triple the above numbers in these specialties were aboard as military physicians at all times, this would provide an abundant pool both for mobilization and the provision of full support in combat areas. Even if the contingency is prolonged, this number would allow time for orderly augmentation of the number of physicians and timely rotation. Therefore, for these three specialties, the distribution of post-residents would be as follows:

Specialty	Military	Civilian	Total
Internal Medicine	125	66	191
Orthopedic Surgery	60	59	119
Anesthesiology	40	114	154
	225	239	464

TABLE C-5

SPECIALTIES WITH SIGNIFICANT PROPORTION OF ASSIGNMENTS TO AIR SQUADRONS, SHIPS AND FMF IN FEBRUARY 1972 AND NUMBERS ASSIGNED TO SHIPS, AIR SQUADRONS AND FMF IN SEPTEMBER 1972

Specialty number	Specialty title	1972								1967		
		Total	Hospitals			Regional medical center and dispensaries	Air squadron	Ships	FMF	Air squadron	Ships	FMF
			Post-resident or post-intern	Residents	Interns							
00	General medical officer	1424	472	11	154	512	2	172	99		204	188
05	Aviation medicine (flight surgeon)	298	24			97	120	15	42	128	19	74
06	Aviation medicine (aviator)	12	1			4	5	2		2	1	1
08	Submarine medicine	78	5			21		52			60	
11	Public health	4				3		1			1	
13	Occupational medicine	3				2		1				
45	Physiology	1						1				
60	General surgery	257	162	68		14		13			53	31
	1972 Totals	2077	666	79	154	653	127	257	141			

Summing up the distribution of the 1438 post-residents in table C-4 results in 1143 civilian and 295 military physicians.

Table C-5 lists eight specialties in which a significant portion of physicians are used in combat situations and are also used heavily in military-type assignments (air squadrons, FMF, ships) in time of peace. The largest such group is general medical officers; of the 1424 listed in table C-5, 154 were interns, 11 were residents, and 1259 were post-interns. There were 273 general medical officers assigned to ships and FMF in 1972, and 392 in 1967. If they were to be deployed in the same way as in February 1972, the dispensary billets appear to be the main candidates for civilianization. BuMed has expressed a desire to use civilians particularly for the more remote locations and less desirable assignments;[13] many of these are dispensary assignments for general medical officers. Perhaps half of the 411 assignments to other dispensaries could be filled with civilians. The billets in hospitals would remain military in order to maintain rotation billets for the relatively large number of GMO's assigned to ships and FMF. This would result in 200 civilian and 1059 post-intern general medical officers.

There were 1[illegible]9 post-resident general surgeons in 1972. Only 13 of these were assigned to ships in 1972 and none to FMF; however, in 1967 there were 84 assigned to ships and FMF. In accordance with the conservative assumptions employed concerning mobilization, we have not allowed for any civilianization of these billets. We have also assumed that the remaining billets in table C-5 would remain military. Most of these billets are in aviation medicine and submarine medicine. Therefore, of the 1844 post-resident and post-intern physicians in table C-5, we estimate that 200 would be civilians and 1644 military.

There remain the 466 physicians listed in the last seven columns of table C-1 for which specialty information is not available. We assume that the 293 physicians in administration, research, TPP, marine construction battalions and other mobile units would remain military and the 15 assigned to AFEES would be civilianized. The 158 listed under "education and training" are excluded from the calculations, similar to the treatment of residents and interns. Some of these assignments are military in nature (e.g., Naval War College), but many of these are at civilian institutions receiving post-graduate training which is not available within the Navy. Of this latter group, most are probably in specialties which would be largely civilianized.

Table C-6 summarizes the hypothetical distribution of the entire 4570 physicians on board as of February 1972:

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[13] CHBUMED Memo for CNO, 20 September 1972, loc. cit.

TABLE C-6

SUMMARY OF ESTIMATED NUMBER OF POST-RESIDENT POSITIONS WHICH COULD BE CIVILIANIZED, FEBRUARY 1972 STAFFING LEVEL (4570)

	Post-resident					
Source	Civilian	Military	Residents	Interns	Education and training	Total
Table 3	97	10	17			124
Table 4	1143	295	465			1903
Table 5	200	1644	79	154		2077
Table 1	15	293			158	466
	1455	2242	561	154	158	4570

According to these estimates, about 40 percent of the post-resident (and post-intern) physicians on board in February 1972 could have been civilians without jeopardizing any of the commonly stated military requirements, notably, without impairing the mobilization base. The number of physicians remaining in uniform would provide a sufficient mobilization base to meet a contingency of the magnitude of Viet Nam, and to meet it immediately. The 40 percent estimate, therefore, is a highly conservative, or minimum estimate, of the portion which could be civilianized.

Approximately the same percentage of all physicians in February 1972 could have been civilianized. The civilianization of most or all of the positions in many specialties would mean that the Navy would no longer offer residencies in those specialties, but would use post-resident civilians. For example, in February 1972, 51 of 214 obstetricians and gynecologists were residents. There would no longer be any need for residency programs in these specialties. The principal residency programs would be in those specialties for which there is a heavy military use, at least in time of war, viz., internal medicine, orthopedic surgery, anesthesiology, general surgery, aviation medicine and submarine medicine.

Of the 561 residents in 1972, 300 were in fields other than the above. These 300 residencies could be eliminated, thus eliminating 300 military positions, and we would

simultaneously add a certain number of post-resident civilians to perform the work previously done by the residents.[14]

In Part I we estimated that a resident was about one-third as productive as a fully-trained physician; using this estimate, 100 civilian post-residents would replace 300 military residents, and a total staff of 4370 comprised in this manner would be the equivalent in effectiveness to the staff of 4570. Similarly, many of the 158 assignments to training and education are probably in specialties to be civilianized. Post-graduate training opportunities would, of course, continue to be provided for both military and civilian physicians, but the point here is that a portion of these 158 physicians would be civilians. The interns, on the other hand, would remain military, and the net effect is that the proportion of the total number of physicians who would be civilians would be roughly the same as the proportion of post-residents.

D. Estimate of Billets Which Could be Civilianized at 3000 Staffing Level

The next question to be addressed is the proportion (and number) of physicians who could be civilians if the total number were reduced to 3000 or 3500. Would it still be possible to civilianize 40 percent of the positions while meeting military requirements? We believe it would.

The best way to address the question would be by an examination similar to that just completed for the 4570 level. However, that is not possible without knowledge of what the composition of the reduced force level would be by specialty and assignment. That is, we would need the same type of data as in tables C-1 and C-2 for the new force level, and we do not have these data. It is known that BuMed plans to use physicians somewhat differently in the future, even if the staffing level were to remain at 4570. A principle objective is to minimize the number of professionally undesirable billets. Two specific actions currently being undertaken are to remove physicians from ballistic missile submarines and to staff FMF units at partial strength, assigning physicians to clinical duty, subject to immediate recall to the FMF units as the need arises. It appears that the reduction of professionally undesirable billets will result in a greater proportionate reduction of peculiarly military types of assignments than of other billets.

[14] It should be recalled that we are estimating the number of positions which could be civilianized without jeopardizing military capabilities. However in many specialties which could be civilianized, it would be less costly to sponsor a medical scholarship and provide residency training. Another possibility, not analyzed here, is to sponsor the scholarship and permit the physician to undertake civilian residency training as a member of the inactive reserve.

BuMed presented plans for reductions in strength of 250, 500 and 1000 physicians to the CNO in March 1972, and these are reproduced in table C-7.[15] However, the reductions are shown only by general type of assignment and not by specialty. BuMed noted in the briefing that a reduction of 1000 would require major facility closures, but that it was not possible to predict which facilities would be closed. Evidently, reduction by specialty was not known either, for this would be affected by the facilities to be closed.

We can draw some inferences concerning specialties from table C-7. Most of the reductions for FMF units and ships (other than submarines) would consist of general medical officers, but there is no information about the specialties involved in the 748 billets to be eliminated in hospitals and dispensaries in the event of a total reduction of 1000. However, the other 252 billets (25 percent) involved in a reduction of 1000 are all post-resident billets which we considered would be filled by military physicians in our analysis above. Thus, it would appear that at least 40 percent of post-resident billets could be civilianized even at greatly reduced staffing levels.

However, it remains to be seen whether there would be a sufficient number of military physicians left in the six specialties primarily affected by mobilization in the event of an overall reduction of 35 percent, or from 4570 to 3000 physicians. In a reduction of this magnitude, it is unlikely that all specialties would be reduced in the same porportion. Also, the reduction in post-resident billets would be somewhat less than 35 percent if the residencies were eliminated in those specialties to be wholly or largely civilianized. Nevertheless, table C-8 has been prepared under the assumption of a 35 percent reduction in each of five of the six specialties (excluding aviation medicine) in order to get a rough estimate of the adequacy of the remaining number of specialists for mobilization.

Column 1 shows the total number of post-resident physicians in these specialties on board in February 1972. (For general medical officers, post-interns are shown.) Columns 2 and 3 show the hypothetical allocation of these physicians among military and civilians, according to the analysis presented above. While we estimated that 40 percent of all post-resident physicians could be civilians, this differed greatly among specialties, and column 4 shows military physicians as a (hypothetical) percentage of the total for the six specialties at the February 1972 staffing level. Column 5 shows the total number of physicians (military and civilian combined) remaining if the numbers in each specialty were reduced by 35 percent. Column 6 shows the number of military physicians remaining in each specialty if the same proportion of billets were military after the reduction as before. Finally, column 7 shows the numbers in each specialty assigned to FMF, ship (other than submarine) and air squadron billets in September 1967.

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15. "Reductions in Strength in Health Professions," BuMed briefing for CNO of 22 March 1972.

TABLE C-7

BUMED PLANS FOR REDUCTIONS OF 250, 500, AND 1000 PHYSICIAN BILLETS

Activity			
Hospitals and disps.	69	272	748
Submarine	68	68	68
Other ships	47	47	47
Research	9	18	30
FMFLANT	13	26	26
FMFPAC	11	22	22
DESRON	6	12	24
Flight surgeons	15	15	15
Staff/Admin.	10	20	20
TOTAL	250	500	1000

Source: BuMed Briefing for CNO on "Reductions in Strength of Health Professions," 22 March 1972.

It can be seen by examining columns 6 and 7 that in each specialty except aviation medicine, there would be from 1-1/2 to 2 times as many military physicians on board after the reduction to 3000 physicians as were assigned to FMF, ship, and air billets in September 1967. While the previous estimates of military physicians (for a 4570 staffing level) were based on having three times as many on board as used in these deployments in 1967, the above coverage appears to be quite ample for mobilization in view of the size of the contingency and the reaction time postulated.

The flight surgeon billets were only reduced by 20 in table C-8, rather than by 35 percent. (BuMed estimated a reduction of 15 flight surgeons for a reduction of 1000 in total physicians.) This specialty is somewhat different than the others in that a large proportion is assigned to air squadrons at all times and many of these will be shore-based in the U.S.; only a few more were assigned to air squadrons in 1967 than in 1972. We concluded that all of these billets would remain military. Even if the reduction in flight surgeon billets were no greater than the 20 we have postulated, 278 would cover the 221 assignments to FMF, ship, and air squadrons in 1967.

TABLE C-8

ESTIMATE OF NUMBER OF MILITARY PHYSICIANS IN 6 SPECIALTIES AFTER 35 PERCENT REDUCTION IN TOTAL PHYSICIANS AND CIVILIANIZATION OF 40 PERCENT OF REMAINING BILLETS

Specialty	(1) Total[a] post-residents on board, 2/72	(2) Military[b]	(3) Civilian[b]	(4) Military as percent of total	(5) Total post-residents at 3000 staffing level (column 1 x 65%)	(6) Number military (column 4 x column 5)	(7) FMF, ship, air in 9/67
Internal medicine	191	125	66	65	124	80	42
Orthopedic surgery	119	60	59	50	77	39	20
Anesthesiology	154	40	114	26	100	26	13
General surgery	189	189	0	100	123	123	84
General medical officer	1259	1059	200	84	818	687	392
Aviation medicine	298	298	0	100	278[c]	278	221

[a] Includes post-intern general medical officers.

[b] If total number of physicians on board in February 1972 were composed of military and civilians according to the analysis presented in this paper.

[c] Reduction of 20 flight surgeons instead of 65 percent.

We conclude that at least 40 percent of all post-resident billets in a total force of 3000 physicians could be civilianized and still provide mobilization capacity even in the six specialties most affected. However, in five of these six specialties, less than 40 percent of the billets would be civilianized and none would be in two of the specialties. It also appears that at least 40 percent of the total billets at the 3000 staffing level could be civilianized. The reason is the same as discussed above with respect to the 4750 staffing level, viz., that residencies in many specialties (now filled by military residents) could be eliminated and the residents replaced by a smaller number of civilian post-residents.[16]

E. Conclusions and Comparisons with DoD Estimate

As discussed above, it would be preferable to estimate the proportion of the billets which could be civilianized at a staffing level of 3000 in the same manner as was done for the 4570 level, that is, by examining the composition of specialists and types of assignments. However, these data are not available for hypothetical future force levels. Therefore, what we have done is ask whether the 40 percent civilianization estimate at the 4570 level, made under conservative assumptions, would be unreasonable at the 3000 staffing level. In particular, we wanted to make sure that under this mixture, a sufficient number of physicians would remain in uniform in the six specialties most heavily utilized in mobilization and combat support. Our conclusion is not that 40 percent civilianization is the best proportion, or the appropriate one at all staff levels. Rather, it is that this is a minimum estimate of the proportion that could be civilianized at the 4570 level, and is not inappropriately high at a staffing level of 3000 or higher.

Finally, it should be noted that this would result in the civilianization of 1200 of 3000 Navy physician billets. Thus, by our estimates, the Navy alone could civilianize more billets (with due regard for military requirements) than DoD estimated was possible for the three armed forces combined. It will be recalled that DoD estimated that 938 of a total of 11,300 billets could be civilianized.

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[16] If civilianization were to occur to the extent and in the manner envisioned in this paper, the total number of physicians would be somewhat lower than estimated in CNA Study 1023, probably in the range of 100 to 150 less.

VI. METHODS OF CIVILIANIZING AND COMPENSATION STRUCTURE

A. Compensation Structure for Direct Employees

Implicit in our analysis of civilianization is that the Navy would employ salaried physicians who would work with military physicians at Navy facilities. The few civilian physicians the Navy now uses are employed under Civil Service and work primarily in industrial medicine assignments. Both the DoD-HEW report and BuMed recognize that if the armed forces are to be able to recruit civilian physicians successfully, both the level and structure of the present compensation system will have to be greatly altered. Our recommendations concerning civilianization are also contingent upon changes in the compensation system.

The Civil Service general schedule is too low to be competitive for physicians. Moreover, grade placement within the schedule is determined by position classification, which in turn is based on factors largely irrelevant in this labor market. The Veterans Administration, on the other hand, has a separate compensation system for physicians, dentists and nurses which results in higher salaries and gives greater recognition to personal ability. (This latter feature is known as "rank-in-the-man," as contrasted with "rank-in-the-job" under Civil Service.) The VA employed about 4700 full-time and 800 part-time physicians in 1972, excluding residents and interns, at locations throughout the country. They have generally been able to recruit successfully, although recently difficulties have been reported for certain specialties and geographic locations.

In 1972, a federal Job Evaluation and Pay Review Task Force completed a report which reviewed and made recommendations concerning job classification and pay procedures throughout the federal government.[17] Of concern here is the portion dealing with "Special Occupations Evaluation Systems," which proposes individual national pay schedules for each of a small number of occupations, including physicians, dentists and nurses. All federal physicians would be included; there would no longer be separate Civil Service and Veterans Administration schedules. The proposed system would give greater recognition to the "rank-in-the-man" concept, which is widely agreed to be more appropriate for physicians than "rank-in-the-job." The Administration has not yet submitted the legislative recommendations to the Congress which would be necessary to implement this.

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[17] "A Final Report Submitted by the Job Evaluation and Pay Review Task Force to the U.S. Civil Service Commission" (the "Oliver Report"), U.S. Civil Service Commission, Washington, D.C., January 1972.

We agree that the general level of federal civilian physicians' salaries must be raised above present Civil Service levels, and that greater emphasis be placed on "rank-in-the-man." We also wish to stress two other features of the compensation structure which will have an important bearing on the success of civilianization. The compensation structure should explicitly recognize salary differentials both among specialties and geographical areas, or at least provide sufficient flexibility to permit these differentials to be paid. In the private sector, we observe considerable differences among earnings in different specialties and, within a given specialty, among geographic areas. Unfortunately, the Task Force recommends a national pay scale; this was reportedly at the insistence of the Health Services Advisory Committee, a group consisting of major federal users of health personnel.

Unless these differentials are recognized, we anticipate difficulties in recruiting in some specialties and for some areas. These areas will often be precisely the ones in which the Navy would most like to civilianize.[18] Physicians are clearly not indifferent among geographical areas; therefore, adoption of a single national scale for any specialty will have one of three results. (1) The scale may be set so high as to fill all civilian billets, even in the least desirable areas. In this case, civilianization will be unduly expensive because the government will be paying physicians in most cases more than necessary. (2) The scale may be set at the level which enables the government to attract physicians in the desirable areas, in which case there will be complaints of "shortages" in other areas. (3) The most likely result is that it will be set somewhere in between these extremes, with the result that the government will pay more than necessary in some areas and will be unable to fill positions in others.

Therefore, we strongly recommend that the Navy and DoD seek to obtain a civilian pay system in which the general level of compensation is high enough to compete with the civilian sector and is structured so that differentials may be paid in those specialties and those geographic areas where they are needed.

B. Alternative Forms of Civilianization

There are three alternative ways in which medical care could be provided to Navy beneficiaries by civilians besides direct employment. We shall describe these briefly, and then discuss them.

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[18] The Task Force recommends national scales for doctors, dentists, and nurses. Currently, area differentials for nurses are explicitly provided under both Civil Service and the Veterans Administration where the basic compensation schedules are too low for the government to compete successfully in the market. In this respect, the Task Force recommendation represents a step backward.

The first is the expanded use of CHAMPUS. This program is described in detail and analyzed in CNA Study 1023.

The second is discussed in the DoD-HEW report.[19] Under this plan, the services would contract for care by civilian physicians in community facilities in certain locations. It differs from CHAMPUS in that such care would be extended to active duty personnel as well as dependents and retirees. The report makes no mention of deductibles or coinsurance features under this plan, but presumably these would be zero because active duty personnel are included. Payment to the providers of health care would be on a fee-for-service basis.

The third plan was proposed by Lando.[20] It is similar to the Kaiser Plan, but with some important differences. The Kaiser Foundation Health Plan contracts with Permanente Medical Groups to provide services to subscribers (on the basis of a capitation fee); the hospitals are owned by a third group, Kaiser Foundation Hospitals, with which the Health Plan also contracts for the provision of hospital services. Under Lando's plan, DoD would contract with medical groups to provide care in facilities owned by DoD. The medical group would be paid on a fee-for-service basis, and individual physicians would receive "a basic salary augmented by a productivity bonus." The DoD medical facilities would be staffed either entirely by civilian physicians or entirely by military physicians.

The principal (valid) objection to expanded use of CHAMPUS is that past studies show the cost of care under CHAMPUS to be greater than the cost of care in military facilities. Unfortunately, all estimates of the cost of care in military facilities of which we are aware understate that cost by a large, but unknown amount. Pending completion of a valid cost study, and we are not optimistic about the possibility of such a study being successfully completed, we have proceeded under the assumption of no major policy changes to greatly expand or contract CHAMPUS usage. In any event, our analysis still provides an estimate of the division of billets between military and civilian physicians.

The DoD-HEW contracting proposal is subject to the same difficulty, as well as others mentioned in their report. This proposal would be even more costly to the government than CHAMPUS because of the extension of eligibility to active duty personnel and the apparent elimination of coinsurance and deductible features. However, it may be less costly than maintaining government physicians and medical facilities at small installations with light workloads.

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[19] Op. cit., pp. 58-68.

[20] Op. cit.

As we have noted, Lando asserted that two-thirds of physician billets could be civilianized. He furnished no basis for this, but it may not be unreasonable in view of the fact that under his proposal there would not exist a capability to meet crises with active duty physicians, whereas in our proposal there would be. It is by no means apparent that the creation of a medical corps reserve, as he suggests, would be a more effective way to provide this capability.

If the Navy were to adopt a version of Lando's proposal, modified to maintain mobilization and combat support capability, a smaller proportion of the total billets could be civilianized than under our proposal. This is because entire facilities would be either civilian or military under his proposal. Under our proposal some entire specialties could be civilianized, others would remain military, and still others would be mixed; civilian and military physicians would work at the same facilities. Under the Lando proposal, if the hospital at Charleston were to be military, then military obstetricians, pediatricians, etc., would have to be provided. On the other hand, if the hospital at Boston were to be staffed entirely with civilians, we would need additional specialists in general surgery at military hospitals to provide mobilization and combat support capability in this specialty.

There are several other respects in which Lando's proposal does not seem superior to the alternative of hiring physicians directly, to which it was never compared.

We have been able to perform an analysis of the number and proportion of physician billets by specialty which could be civilianized by hiring physicians directly. To the best of our knowledge, this has not been done previously for any of the methods of civilianization. We have not been able to analyze the other alternatives, but have had to resort to the usual discussion of advantages and disadvantages of each. Subsequent information may show another alternative to be preferable, but in our judgment this does not appear likely. In any event, we think it both important and timely to estimate the possible extent of civilianization under at least one of its forms rather than awaiting the data needed to analyze all the alternatives.